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Sand and Gravel Plant With Unusual Features

Makins Sand and Gravel Co. at Sulphur, Oklahoma, Has Economical Operation Although the Deposit Requires Blasting

WHILE the state of Oklahoma has many excellent arterial highways of concrete, there yet remains a large mileage of hard surface roads to be constructed. Such construction has been temporarily slowed down by present conditions, but this did not deter the Makins Sand and Gravel Co. of Oklahoma City from going ahead with the construction of a modern plant at Sulphur, Okla., a small community about 100 miles south of Oklahoma City. The company has two sand plants at Oklahoma City and is also in the ready-mixed concrete business there, using the transit mixing system.

The plant at Sulphur is of steel construction throughout and uses belt conveyors exclusively for elevating and conveying. Vibrating screens are used for both scalping and for the final classification and jaw crushers are used for crushing. The operation includes a number of interesting features.

Gravel Deposit Consists of a Cemented Conglomerate

The gravel deposit itself is unusual in that it is a cemented gravel conglomerate which requires blasting to loosen it. There is practically no overburden. Holes are put down with a Ft. Worth Well Machine and Supply Co. model L "spudder." This is the oil field term for a churn-drill.

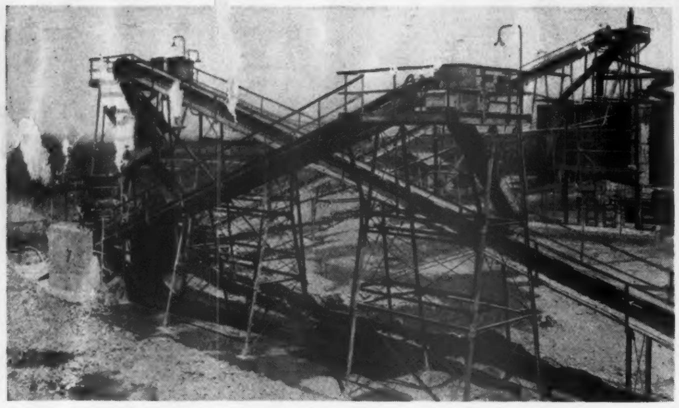
No regular system of drilling and shooting is practiced because of variations in the extent to which the deposit is cemented. The pit has some resemblance to a low-face quarry operation. Hercules dynamite of 40% strength and safety fuse and caps are used for breaking down the conglomerate.

A 1¼-yd. P. and H. gasoline shovel is used for excavating the material, loading to trucks for transportation to the plant. At present three trucks are used for this purpose (4-ton Federal and Diamond T).

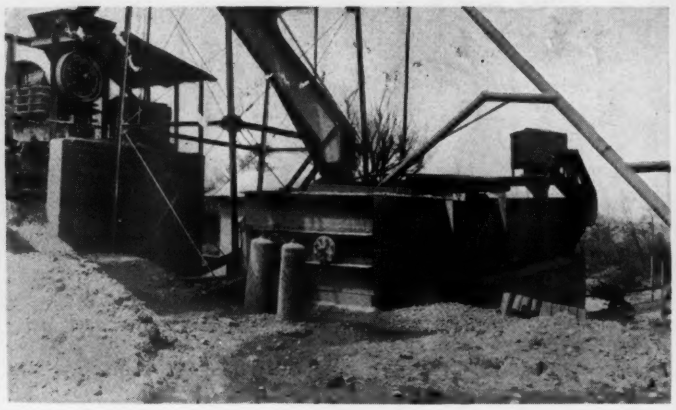
As the conglomerate breaks into lumps of considerable size, the use of crushers for primary and secondary crushing is a necessary part of the operation. The primary crusher is an 18-in. by 36-in. Diamond jaw crusher, and the secondary is a 14-in. by 26-in. jaw of the same make, both "V" belt driven by Fairbanks-Morse motors.


Storage bins and sizing screens, at left; and scalping and recrushing arrangements, at right


Gasoline shovel used for excavating and one of the trucks used to transport the material to the plant



Scalping screen and recrusher, with final sizing and washing plant beyond at right



The material passing the scalping screen is scrubbed in a log washer before going to the final sizing screen

The gravel particles themselves range in size up to about 3 in. and are eminently suitable for concrete aggregate. Associated with the conglomerate is a small amount of clay, making the use of a log washer advisable, and a 24-ft. Telsmith double screw log washer is used for this purpose. Air for use in drilling in the pit is supplied by a portable Ingersoll-Rand compressor. A Fordson tractor is also available for miscellaneous uses around the pit.

As indicated by the accompanying illustrations and drawings of the plant, the flow of material through it is as follows: The trucks from the pit are dumped to a hopper located above the primary jaw crusher and the material is fed from it to the crusher. The material discharged from the primary crusher is delivered by a pan conveyor feeder to No. 1 belt conveyor which is 30 in. wide by 116 ft. long on centers.

The gravel is well cemented and has to be blasted out

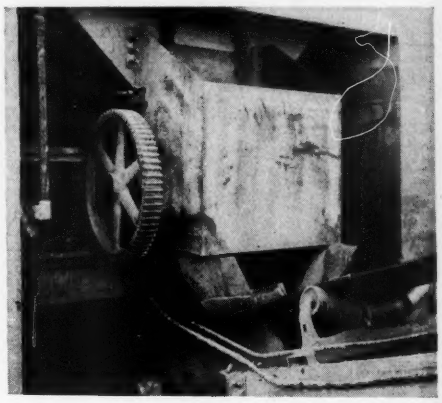
This conveyor discharges to a 4-ft. by 8-ft. single-deck Simplicity vibrating screen, equipped with 1½-in. mesh wire cloth, where any oversize is scalped off and spouted to the secondary crusher. The recrushed material from this 14-in. by 26-in. jaw crusher is returned to conveyor No. 1 by means of an 18-in. by 66-ft. inclined belt conveyor, No. 2.

The material passing through the scalping screen is spouted to the 24-ft. Telsmith log washer from which the scrubbed gravel is in turn discharged to belt conveyor No. 3 (24 in. wide by about 212 ft. long) carrying up to the screens above the bins. Four circular steel silos, each holding about eight carloads, are used as storage bins.

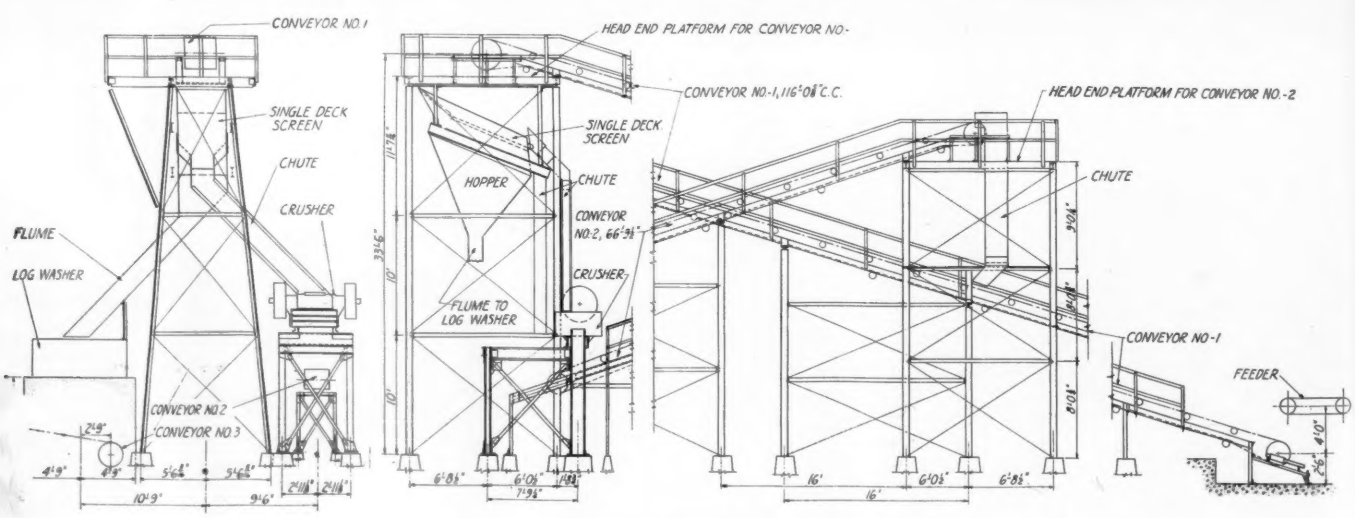
Conveyor No. 3 discharges to a 3-ft. by 6-ft. double-deck Simplicity vibrating screen which separates out two coarse sizes to the bins. The material passing through the lower deck is flumed to two single-deck screens arranged in series to separate out two finer sizes to the bins below.

Material Loaded Out By Belt Conveyor

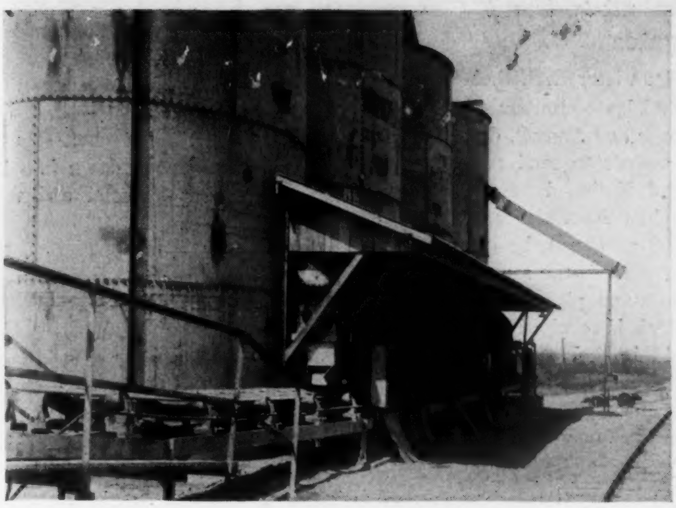
From the bins the sized material is carried by an inclined belt conveyor to a car and truck loading point, the belt also serving as a mixing conveyor for combining the sizes in any desired proportions. This conveyor (No. 4) is 24 in. wide by about 100 ft. long on centers and the feed end is located alongside and parallel to the row of silos



Material from primary crusher is fed to belt conveyor by apron feeder



Side and end elevations of scalping screen and recrusher



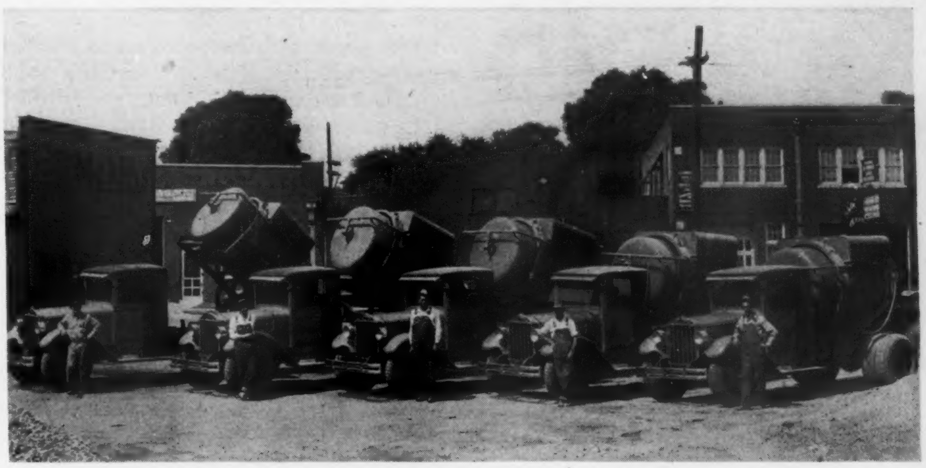
The loading belt is fed by electrically-controlled gates and discharges through chutes to railroad cars or trucks

at ground level. It is fed by means of electrically operated quadrant type gates attached to the side of the silos. Each feeder is operated independently by push button control and is driven by a 3-hp. motor through a Reeves variable speed drive. By setting the Reeves transmission, predetermined amounts of material can be fed to the loading belt and a blended aggregate secured.

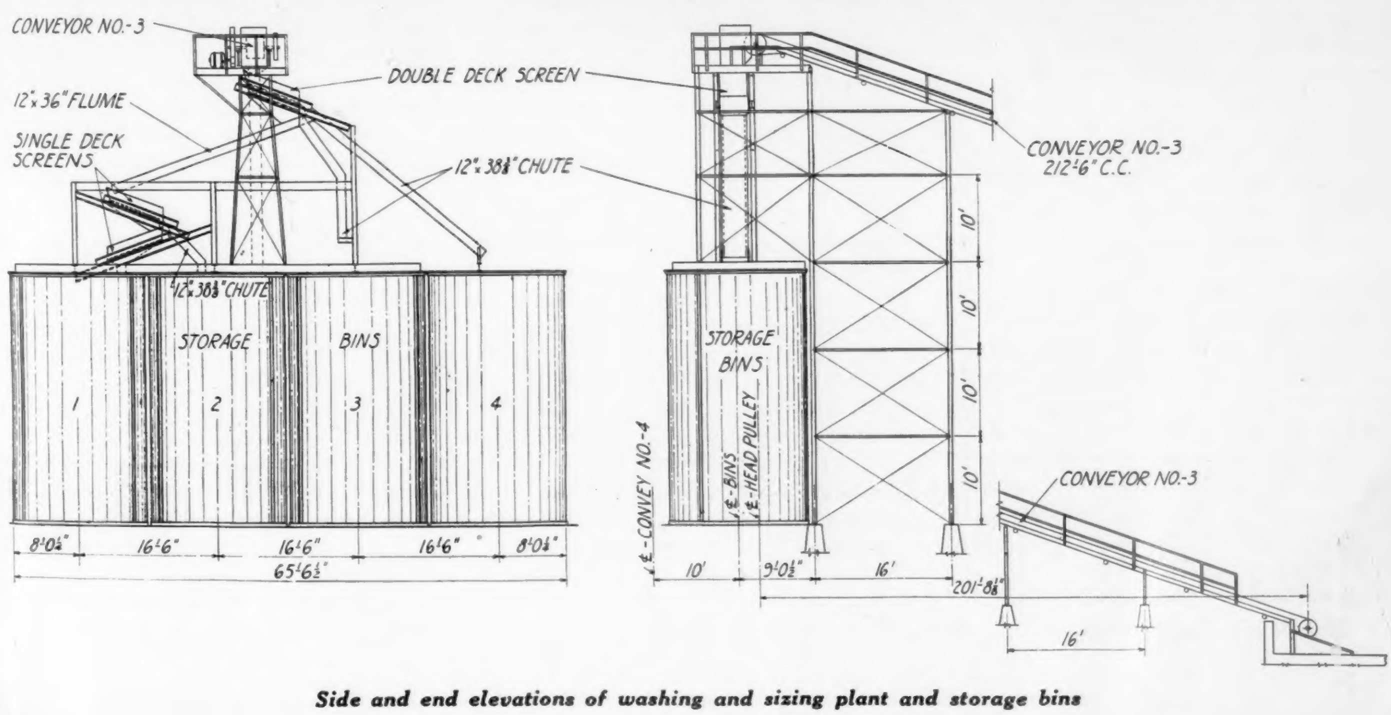
At the loading point a chute with a perforated bottom is provided by means of which the gravel is given a final rinsing. The plant produces no sand, but a cone is to be installed later so that some concrete sand can be recovered.

Water for washing is obtained from a well and is delivered to the point of use by means of an air lift. A 10- by 12-in. class ERI, Ingersoll-Rand compressor driven by a 75-hp. induction motor supplies air for the air lift which delivers 800 gal. of water per minute.

The plant was designed cooperatively by the Makins Sand and Gravel Co. and the Dodge Manufacturing Co., Mishawaka, Ind., who supplied the conveying equipment and the pan feeder. All equipment is Alemite lubricated. The plant has a capacity of 75 yd. per hour and is served by the Frisco railroad. Fairbanks-Morse motors are used throughout, with Cutler-Hammer switches.



Part of the fleet of trucks used for delivering ready-mixed concrete

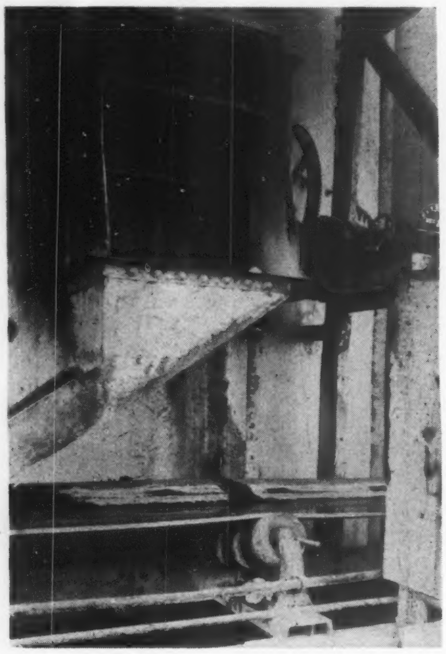


Side and end elevations of washing and sizing plant and storage bins

A General Electric arc welder mounted on a Federal truck is used in both the pit and plant for building up wearing parts and for general repair work.

Ready Mixed Concrete Operations

In Oklahoma City the company has three retail yards and also operates a fleet of nine 2½-yd. Paris transit mixers. These are mounted on Diamond T and Federal trucks. Two of the yards are equipped with Blaw-Knox weighing batchers for weighing all sand, gravel and cement for the transit mixers. A measuring tank is used to ensure



One of the motor-driven feed gates

the right amount of water so that uniform concrete of any mix, strength and water-cement ratio can be furnished.

The truck mixers provide a capacity of about 100 cu. yd. of concrete per hour, depending upon the length of haul, and a continuous pour of 2,000 cu. yd. without stops or delays has been made. The company maintains its own repair shop, where all mechanical work is done on trucks and other equipment and each truck is checked daily.

Cement in cloth sacks is used and is handled on a belt conveyor from the warehouse to a platform at the weighing batcher. This method makes it possible to change brands quickly whenever necessary. The empty sacks are returned through a convenient chute to the sack house for cleaning.

At two of the yards General cranes with ⅝-yd. clamshell buckets are used for unloading materials from cars and also for charging the hoppers above the weighing batchers. At the third plant, which delivers only dry aggregates, an Erie steam shovel with ¾-yd. bucket is used.

The offices of the Makins Sand and Gravel Co. are in Oklahoma City. C. H. Makins is owner; E. H. Hoover, general manager; and C. N. Deal, superintendent.

Adhesion of Asphalt to Sand Aggregates

PART III of a series by Victor R. Nicholson, chemist of the Chicago Bureau of Streets, published in *Roads and Streets,* discusses the adhesion of asphalt to sand surfaces in asphalt paving. Noting how the rain had washed the asphalt from the sand grains of an experimental pavement, he got the idea for a water test. In this the sample is broken to ¼-in. pieces and placed in a flask with water. The flask is revolved end-over-end while it is held in a water bath, as the temperature has to be controlled. It is usually held at 140 deg. F., although sometimes other temperatures may be used.

After 1 hr. of this it was found that a sample of rock asphalt was not much affected. With the same treatment a sample of a mix made with coarse concrete sand uncovered badly. A sample of ordinary sheet asphalt paving did not uncover quite so much.

After developing this test he studied the work of Professor Bartell on adhesion tension and applied it to asphalt paving problems. This part of the article gives the mathematics of surface tension and adhesion with considerable detail. From this study a second test was worked out.

In this test the coated sand is agitated in flasks with increasing amounts of a good solvent. Thus with five flasks the concentration of solvent to asphalt might be 20%, 40%, 60%, 80% and 100% by weight.

The flasks are agitated periodically. The better the adhesion between the asphalt and the sand grains the more solvent must be present before the asphalt will begin to come off. In this way the adhesion to different materials may be compared. Both these tests are standardized as regular laboratory tests, and full details are given in the article.

As is well known, different materials show different qualities of adhesion. Mr. Nicholson's experiments have shown that the presence of colloidal material on sand has a pronounced influence on the adhesion of asphalt and his work with the tests described confirms this finding. The purity of limestone used as filler had a profound influence in promoting adhesion. Crushed marble gave high results. The author notes that in Europe limestone rock with a purity of 98% is insisted on for filler. Crushed silica sand was found to retain the asphalt and best where crushed Ottawa sand was used as a filler. But asphalt sticks very poorly to silica sands from Florida. (Professor Bartell found differences in silica in the way water adheres to them.) It was difficult to make asphalt adhere to Wisconsin granite, but granite from Stone Mountain, Ga., held asphalt well. Lake sands varied considerably and it is judged that the adhesion is better on sands which come from a quiet part of the lake, which retain more colloids.

There was found to be a wide variation in adhesion due to the temperature at which the sand and asphalt were mixed. The best results were with the higher temperatures.

The paper discusses some of the reasons given by other writers for differences in adhesive qualities. The author finds the main reason lies in the colloidal content of the mineral aggregate. Sheet asphalt stands well because water cannot get down into it if the adhesion between the sand and the asphalt is good.

Missouri-Kansas Rock Asphalt Deposits

WITHIN the past few years much has been done to stabilize the rock asphalt industry in Missouri and Kansas and in the past year new steps have been taken to place the business on a more substantial basis, a recent article in *Roads and Streets* says.

The better known deposits of bituminous sandstone are found in Barton, Vernon, Cedar and Lafayette counties in Missouri and Linn county, Kansas. The better known bituminous limestones are found in Linn county, Kansas, and in Cass, Dade and Barton counties in Missouri. Deposits are found in other localities but so far have not been developed.

The asphaltic sandstones are lens-shaped bodies with a maximum known thickness of 30 ft. and may taper off to a feather edge.

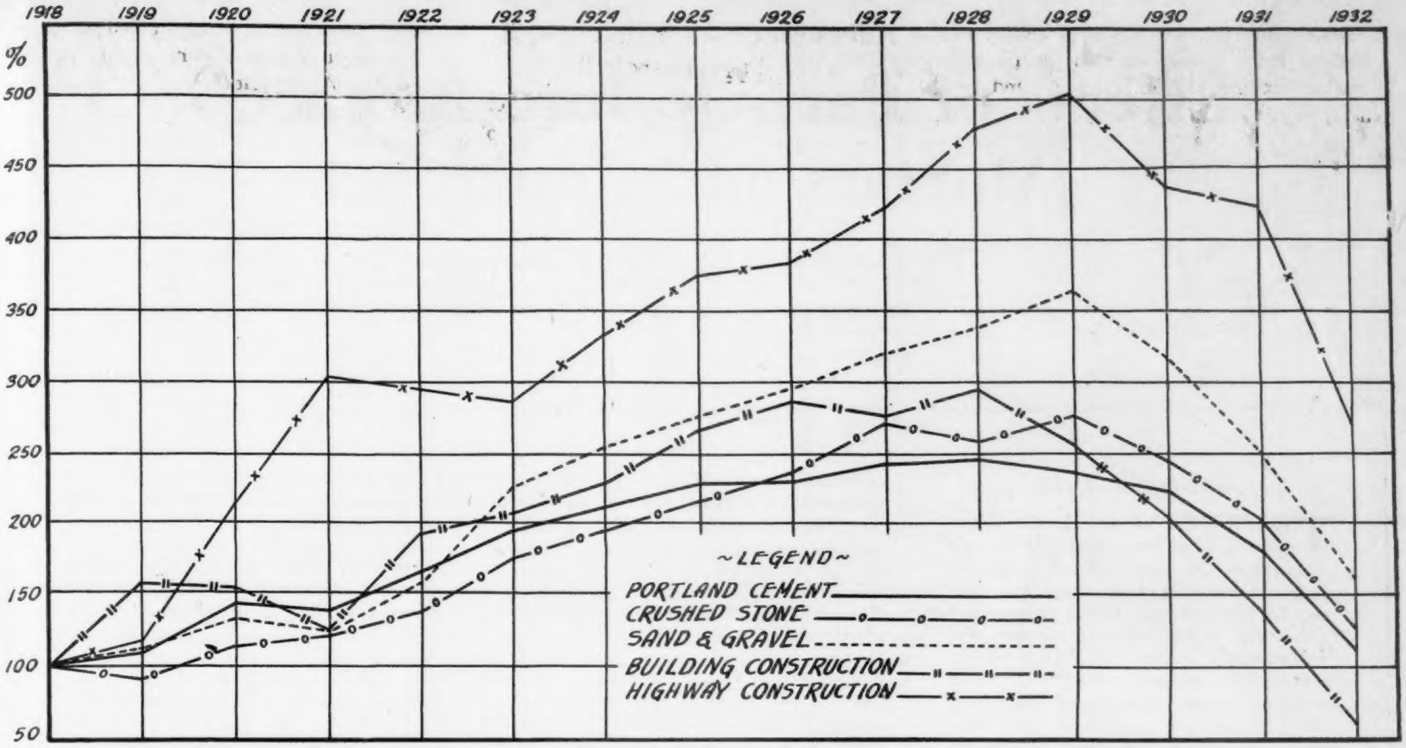
The total bitumen content may vary from a trace to as much as 14%, by weight. Great variation exists throughout deposits, both laterally and vertically. The characteristics of the bitumen also vary widely between a light, oily fluid only slightly colored black and a hard, brittle solid. This condition makes processing difficult, though deposits have been found where no processing other than crushing is required.

While the presence of these deposits has been known for more than 60 years, their development has been of importance in recent years only. These same districts have been prospected for oil but large production has never resulted. Now it is believed that these rock asphalt deposits may be the nucleus of a large industry.

A number of private companies have been active in the investigation and the development of these deposits, as well as the Missouri State Highway Department. The deposits being worked are near the surface of the ground so that they may be worked by stripping. At present there are no especially large plants, though it is said that interests behind some of the projects represent substantial parties.

The plants usually consist of a crusher, rolls, screening equipment and inclosed pug mills. Portable plants are also in use. Many of the plants maintain laboratory control. Batch mixing is usually practiced.

In addition to its experiments with the production of rock asphalt, the state highway department of Missouri has also placed sample roads of different types of rock asphalt from which useful information is expected regarding its best use and practice.



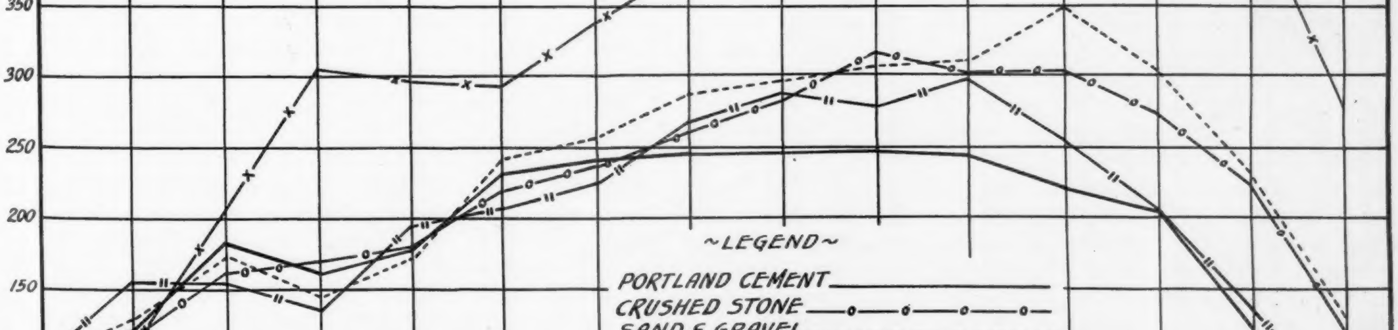
Production in tonnage of portland cement, sand and gravel, and crushed stone, and value of building and highway construction*

Value and Tonnage of Concrete Materials and Highway and Building Construction

THE accompanying charts show the relation between value and tonnage of portland cement, crushed stone, and sand and gravel. It might be concluded from these that sand and gravel have participated to a greater extent in highway construction than have the others; also that building construction is very important in consumption of the products of these industries.

Some manufacturers of cement have been inclined to consider highways their one major market. It is therefore interesting to note that decline in cement consumption started with decline in building volume, while highway construction and crushed stone and sand and gravel sales were increasing.

Since the construction of homes is generally expected to be the next important construction market, a market which has not as yet been sold on the necessity and economy of fireproof construction, the rock products industry has a big job ahead if it is to participate to an important extent in the business in the housing field. The concrete products industry is expected to play an important part in this.



Value of portland cement, sand and gravel, and crushed stone, and building and highway construction*

*Values shown are in percentage of 1918 figures. Figures on highway construction included total and interest on bonds and notes (figured 15.9% of total expenditures in 1929); also equipment and miscelleaneous, which in 1929 figured 11.5% of total expenditures for the year

Effects of Particle Interference in Mortars and Concretes

The Function of Grading of Aggregates

By C. A. G. Weymouth
Consulting Engineer, Los Angeles, Calif.

Editor's Note

THE WORK of C. A. G. Weymouth was first brought to my attention in one of the larger laboratories in Los Angeles, and my informant was much impressed with it. Very shortly after Mr. Weymouth called and we went over his papers together. His original paper contained not only the theory of particle interference as given here but a discussion of the water-films into which the water is divided by the fines in the mix and their supporting power which makes plastic mixes possible. The two subjects are connected since it is the size and ununiformity of the voids that are made by particle interference that prevents the formation of these water-films in portions of the mix, lowering the strength and workability.

However, for the sake of brevity and simplicity, he decided to omit this portion of the paper and also a great part of the mathematical analysis. There was a considerable amount of data from experiments, tables and graphs, and I have suggested that he make a separate paper of these.

Mr. Weymouth has "sold" his ideas to some of the men who are most competent to judge its merits, here in Los Angeles; and they are regularly used in the examination of aggregates for both public and private work in at least two of the important laboratories here. His ideas do not suggest the adoption of rigid gradings like the ideal gradings of Fuller and others, for while there is no doubt but that these make concretes that are very satisfactory in both strength and workability, he finds that there are many gradings which will do as well. The real ideal curve of grading is therefore based on economy and not the physics of concrete. The point is that one may carry economy too far in the wish to get as low a cement content as possible, sacrificing workability, and, if it is carried far enough, strength as well, through particle interference. He also points out that efforts to set up ideal gradings must take into account water-cement ratio and consistency. With so many factors to take into consideration, it seems simpler to him to examine gradings of commercial aggregates and correct them by the addition of those sizes in which the gradings appear to be deficient.

And this is the practical application of his work that is being made today. A sieve analysis is made of the aggregates that it is proposed to use and this is examined for particle interference. Visual inspection is enough to show the size groups in which particle interference is probably present, and a few minutes' work with the slide rule confirms or does not confirm the eye examination. Where interference is present or where a correction could be made for the sake of economy the material required is figured in a very simple way. In most of the cases of which the writer knows, the difficulty came from deficiency of fines in the sand, in one or two cases there was a deficiency of No. 4 to 3/8-in. material, and in one case there was a deficiency of both of these. Fortunately such materials are cheap and easily obtained.

The editor has been through a great deal but by no means all or even half of what the author has in a collected form. But it appears from such study that his theories are reasonable and that they connect well with what other investigators have discovered. It is too much to hope that particle interference will explain all the paradoxes and puzzles of concrete physics, but it is the editor's belief that it explains some of them very well.

EDMUND SHAW.

IT IS recognized that deviations of concrete strength by the water-cement ratio law depends upon the grading of its solid materials, cement plus aggregates. It has not been known what function of the grading is involved. My studies, which include several months of special laboratory work, and the analyses of some thousands of tests made in other laboratories, have shown that variations in strength and workability are due to a characteristic of the grading which I have called *particle interference*. This is the result of an excess of any size group of particles, whether among the finer or the coarser sizes. Theoretically, at least, it is possible for particle interference to come even from badly ground cement and this would affect the strength of concrete in just the same way as an overplus of 2-in. sizes, for example.

We may visualize particle interference in this way: Suppose a frame about a foot square and an inch deep lying on the table before us. First, we put in ¾-in. particles in just the right amount so that the average distance between any two adjacent pieces is not less than ⅜-in. and then add ⅜-in. particles to fill all the spaces between the larger size. The layer will be uniform throughout and *all the void pockets will be of about the same size*. The last statement is one that you are especially to remember. This layer can be stirred around, but the smaller pieces will find sufficient clearance to move between the ¾-in. pieces. At the end of the stirring the void pockets will be about the same as at the start.

Suppose we empty the frame and add a few more pieces of ¾-in. than at first. This extra number will so reduce the distance between adjacent pieces that it is a little less than ⅜-in. When we add the ⅜-in. pieces, and stir around as before, we will find that while some of the smaller particles can move freely into and through the spaces between the larger size pieces, the latter will be so close together in other parts of the frame as to prevent the free entrance of the smaller particles into the spaces between them. The void pockets here will be incompletely filled and will be much larger, as a consequence, than in the other portions of the frame. We find a disposition for the ¾-in. and the ⅜-in. pieces to run into groups, each to its own kind. *These two things are always the effect of particle interference, nonuniform void pockets and segregation of sizes.*

Again, if we leave out a few of the ¾-in. pieces from the first example and put in enough ⅜-in. pieces to make up the space,

we have no particle interference, but we have more total voids without changing the size of the void pockets. This requires more mortar to stick the pieces together. But the resulting concrete costs more to make and is no stronger. In the second example (with particle interference) the overall density may be greater but some of the void pockets are much larger than the average, causing segregation or water separation in the cement paste, as will be explained, with a marked loss of strength.

We have here three conditions: (1) a good workable mixture without particle interference (best on account of strength and most economical from the viewpoint of both workability and strength); (2) a mixture with particle interference containing the least mortar and cement but more costly than the others because of the lack of both strength and workability, and (3) a mix workable and of good strength but not economical.

Most concrete mixtures designed by the trial method are in the second and third conditions. To save cement, the designer is apt to add so much coarse material that he gets a decided particle interference, the second condition. To make his concrete thoroughly plastic, he is apt to go to the other extreme and use more fines and more cement than necessary, putting the mix into the third condition.

To illustrate we have taken a flat layer of aggregates. The principle is the same with a deep mass. Keep in mind a size group of particles forming a sort of grid structure through which the finer particles move both vertically and horizontally. So long as they move freely and the mass is homogeneous, the concrete is good. When they cannot move freely, through particle interference, segregation and large void pockets result with a loss of strength and workability.

To understand the bad effect of large void pockets, it is necessary to study cement paste. If we mix cement with half its volume of water, we will have about as wet a paste as will hold all the water. When we put in more water we find that if the mass stands on a mixing slab, say, clear water separates out at the edges. A separation of this nature takes place when cement paste in concrete (which can just be held with its excess water in the normally small void pockets) is enclosed in the enlarged pockets caused by particle interference. I have drawn a diagram, Fig. 1, to show this. In the pocket are cement paste and some particles of sand.

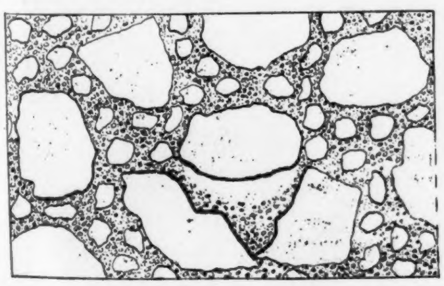


Fig. 1. Diagram showing void pocket

The sand and the cement have settled to the bottom leaving a hole above filled with nothing but water. Such a void pocket will offer little resistance to compressive stresses.

We may lay down as a first principle: Particle interference results whenever the particles of any size group* are in such excess that the average clear distance between adjacent particles of this group is less than the average diameter of the particles of the next smaller group size, plus the effect of a cement film, if the paste is stiff. The mathematical proof and analysis of this will be given later on. Note also that particle interference may occur between any two groups of successive sizes from the finest to the coarsest aggregate when the larger diameters are in excess. There is every reason to believe that it may occur in the cement, and that low strength in cement may result from grinding clinker so badly that particle interference follows.

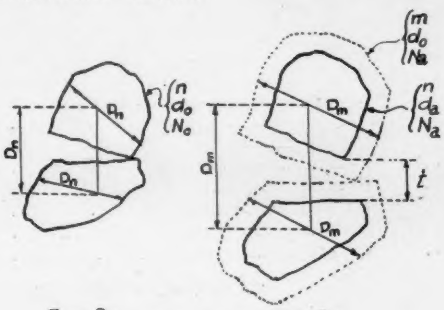


FIG. 2A FIG. 2B

Figs. 2A and 2B. Two particles of a size group and an imaginary group

In ordinary practice, when an operator finds his concrete is harsh or unworkable, due to particle interference, he resorts to the use of more water to increase the flow. Although flow may be improved, segregation of cement in the enlarged void pockets is made more pronounced. Hence it is of vital importance to eliminate particle interference.

Measurement and calculation of particle interference is possible. Call the average clear distance apart of two adjacent particles in any size group t. Call the density of the size group (absolute volume as compared to the total volume) in a dry rodded condition d_o. Thus, if a cubic foot of the rodded group was 60% solid matter and 40% voids, d_o would be 0.60. I use a new term, *relative density*, for the absolute volume of the particles of this group alone, compared to the space it occupies when they are held apart by smaller particles and cement and water (considering this density as if the other solids were not present) and call this d_a.

With these, the formula for t may be expressed as:

$$t = \left[\left(\frac{d_o}{d_a}\right)^{1/3} - 1\right] D$$

where D is the average diameter of the group.

Fig. 2a represents two adjacent particles

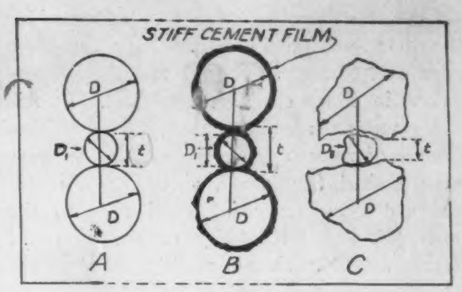


Fig. 3. Relation of t and D

of a size group dry rodded. In any group there is an enormous number of such contacts per cubic foot of material. It is evident, on careful consideration, that the *average distance*, center to center, of touching particles exactly measures the *average diameter* of all the particles in the group. The volume of any irregular particle is proportional to the cube of its average linear dimension. This proportional factor, g, depends upon the average shape of the particles. (In the case of spheres, $g = \pi/6$). Hence for Fig. 2a,

$$d_o = N_o g D_n^3 \quad . \; . \; . \; . \; . \; . \; . \quad (1)$$

where N_o is the number of particles in a unit volume.

In Fig. 2b, an imaginary group, m, a magnification of group n in Fig. 2a, is shown dry rodded. Picture the smaller particles, n, placed in Fig. 2b with their centers coinciding with the corresponding centers of the group m. In this position, the n particles will be separated by an average distance, t. The density d_o of the group in Fig. 2a is the same as that for group m in Fig. 2b, because of the law of equal voids for identical shapes with identical ranges of sizes within the groups. The number of particles in both groups of Fig. 2b will be N_a. Hence we can write the equations for both these groups as follows:

$$d_o = N_a g D_m^3 \quad . \; . \; . \; . \; . \; . \; . \quad (2)$$

and

$$d_a = N_a g D_n^3 \quad . \; . \; . \; . \; . \; . \; . \quad (3)$$

Divide equation (2) by equation (3), and we have

$$\frac{D_m}{D_n} = \left(\frac{d_o}{d_a}\right)^{1/3}$$

But

$$t = D_m - D_n, \text{ and}$$

$$\frac{D_m - D_n}{D_n} = \left(\frac{d_o}{d_a}\right)^{1/3} - 1$$

therefore

$$t = \left[\left(\frac{d_o}{d_a}\right)^{1/3} - 1\right] D_n$$

Let D_1 in Fig. 3 denote the average diameter of the next smaller group size. (In the illustration given of the ¾-in. and the ⅜-in. aggregates in the frame, the value of D would be ¾-in. and of D_1, ⅜-in.) It is evident then that there will be particle interference whenever t is less than D_1. In stiff mixtures, t must be somewhat greater than D_1 because the cement film cannot be pushed aside so easily as in fluid mixtures.

*"Size Group" in this paper means the particles between two of the adjacent sieves recommended by A. S. T. M. Serial Designation C 41-24 for the sieve testing of aggregates.

We can now examine any mixture for particle interference if we have the sieve analyses of the aggregates and the proportions in which they are combined. In this way we can apply the theory to the thousands of records from laboratories all over the United States and abroad, and if we have the necessary information as to the strength and workability of the mixtures, such a study should readily confirm the truth of the theory given here.

Table I is given to illustrate the steps in the calculation of t.

The absolute volumes of the sand and gravel are distributed to the various groups according to the sieve analyses as shown in Line 1. The second line gives the relative spaces in the unit volume of concrete in which each of the groups is spaced and they are computed beginning at the right by subtracting successively the volumes in each group in Line 1 from unity; d_a equals the values in Line 1 divided by the values in Line 2 respectively. The values of Line 4 are assumed from a series of tests I have made on size groups with rounded grains.

The amount of particle interference is shown by comparing Lines 6 and 7. There are two groups in which t is less than the next smaller diameter, Nos. 48 to 28 and ⅜- to ¾-in. groups. In the case of the first of these, however, there is so little of the Nos. 100 to 48 group (only 6%) that these two groups will not cause much, if any, trouble. With the second group, ⅜- to ¾-in., t equals 6.48, while D_1 equals 7.08 mm. This indicates serious particle interference, and we can expect definite loss of strength. (See Fig. 5.)

A stiff cement film will hold the coarser cement particles and cause them to stick to the surfaces of the aggregate. (See B, Fig. 3.) This film will vary from 0.051 mm. (0.0020 in.) to half this thickness, depending upon the richness of the mix. When the concrete, analyzed in Table I, is mixed with less water, as in Tests No. 99 and No. 103 (Table III), where the slumps are 0.5 in. and 1.4 in., respectively, this must be taken into account by adding to D_1 or subtracting from t twice the thickness of this film. Thus in Table I for group Nos. 28 to 14, the effective value for D_1 becomes 0.441 plus 0.102 or 0.543, which is greater than t (0.523). Therefore this mixture will have severe particle interference between coarse as well as fine sizes when the slump is small. This conclusion is shown to be true by an inspection of Fig. 5, where the maximum loss of strength is shown for the stiffest mixture.

Such an examination of all series of tests of major importance that have been published in the last 10 years gives complete confirmation of the theory advanced here.

From this study I have chosen three series for illustration: One of mortars in which there is progressive particle interference; one of concrete which is made by adding gravel to one of these mortars in increasing amounts, and one in which there is particle interference in the coarse aggregate but none in the sand groups.

Table II is from data taken from Series 186 of the Portland Cement Association laboratories, made by McMillan and Johnson, published in 1928, in a report to the Director of Research. From these data there have been calculated the values of the relative density, d_a, the average separation of particles, t, and the effective values of D_1 for the critical group in the sand. These tests are plotted in the usual manner showing the water-cement ratios and the compressive strengths, in Fig. 4. The curve marked 28 da. is the true curve for the cement used, Abrams curve added for comparison.

It will be noted that wherever the value of t is less than the effective diameter, D_1, the strength of the mortar is less than it should be for the water-cement ratio. These values are underlined in the table wherever t is less than D_1. This loss of strength is very evident in Fig. 4 and also the *progressive* loss of strength as particle interference increases. The 1-1-0 mix (one of cement to one of sand, dry rodded volumes) is wholly without particle interference as shown by relation of t to D_1. Its strength therefore is that of the true cement curve for all water-cement ratios. This is equally true of the 1-1½-0 mortar, which is also without particle interference.

Those points which fall to the right of the

TABLE I—CALCULATION OF THE VALUE OF t

Analysis of test No. 107, Series 186. Mix, 1-2½-3. Slump, 5.9 Abs. vol. of Elgin sand is 0.329 and of Elgin gravel is 0.380.

Groups	0 to No. 100	No. 100 to No. 48	No. 48 to No. 28	No. 28 to No. 14	No. 14 to No. 8	No. 8 to No. 4	No. 4 to ⅜-in.	⅜-in. to ¾-in.	¾-in. to 1½-in.
Average D (mm.)	0.084	0.220	0.441	0.877	1.764	3.54	7.08	14.1	28.5
Sand	1%	6%	31%	24%	19%	16%	3%	....	....
Gravel	....	....	....	....	....	....	25%	50%	25%
1. Abs. vol.	.003	.020	.102	.079	.062	.053	.105	.190	.095
2. Rel. spaces	.294	.314	.416	.495	.557	.610	.715	.905	1.000
3. d_a	.010	.064	.246	.160	.111	.087	.147	.210	.095
4. d_o	.600	.630	.650	.650	.650	.650	.650	.650	.650
5. t (mm.)	.245	.251	.161	.523	1.41	3.38	4.55	6.48	25.6
6. Critical t	....	....	.161	.523	....	....	....	6.48	....
7. D_1 (mm.)	....	....	.220	.441	....	....	....	7.08	....

TABLE II. PARTICLE INTERFERENCE IN MORTARS

From Series 186 P. C. A. (Elgin sand, F. M. = 3.14. Approximately d_o = 0.650)

No.	Flow	Slmp.	d	Sacks per yd.	W N	W/C	Comp. str. 28 da.	d_a	No. 28-No. 14: t mm.	No. 28-No. 14: Effect. diam. D_1 mm.
			1-1-0				a/c = 1.413			
1	215	2.4	0.687	16.0	W	0.51	6490	0.114	0.68	0.54
3	......	8.7	0.665	15.6	W	0.57	5990	0.110	0.71	0.44
6	......	10.3	0.654	15.3	W	0.64	5370	0.108	0.72	0.44
10	......	......	0.639	14.9	W	0.71	4950	0.105	0.74	0.44
			1-1½-0				a/c = 2.118			
25	194	3.9	0.710	12.9	W	0.57	5510	0.142	0.58	0.54
26	......	8.6	0.696	12.7	W	0.64	5380	0.139	0.59	0.44
30	......	10.0	0.682	12.4	W	0.71	5070	0.135	0.61	0.44
34	......	11.0	0.670	12.2	W	0.77	4300	0.132	0.62	0.44
38	......	......	0.650	11.8	W	0.84	3970	0.127	0.64	0.44
			1-2-0				a/c = 2.825			
54	186	1.2	0.716	10.6	W	0.63	4550	0.159	0.52	0.54
56	219	6.7	0.699	10.3	W	0.69	4150	0.154	0.54	0.49
59	......	8.4	0.688	10.2	W	0.76	4090	0.151	0.55	0.44
65	......	10.1	0.688	10.2	W	0.83	3740	0.151	0.55	0.44
71	......	......	0.675	10.0	W	0.89	3340	0.147	0.57	0.44
			1-2½-0				a/c = 3.530			
90a	141	0.6	0.722	9.0	N	0.61	3360	0.172	0.49	0.54
91	135	0.6	0.736	9.2	N	0.68	3610	0.176	0.48	0.54
93	183	2.2	0.709	8.8	W	0.75	3560	0.168	0.50	0.54
97	231	6.4	0.696	8.7	W	0.81	3510	0.164	0.51	0.49
101	......	8.6	0.700	8.7	W	0.88	3430	0.165	0.51	0.44
106	......	10.1	0.694	8.6	W	0.95	3210	0.163	0.52	0.44
			1-3-0				a/c = 4.233			
121	144	0.1	0.705	7.6	N	0.67	2590	0.175	0.48	0.54
122	129	0.3	0.721	7.8	N	0.73	2900	0.180	0.47	0.54
124	157	0.8	0.721	7.8	N	0.80	2870	0.180	0.47	0.54
127	198	2.2	0.708	7.7	W	0.87	2890	0.176	0.48	0.54
131	242	6.7	0.698	7.5	W	0.93	2980	0.173	0.49	0.49
135	......	8.4	0.705	7.6	W	1.00	2710	0.175	0.48	0.44
			1-4-0				a/c = 6.650			
146	148	0.4	0.718	6.1	N	0.99	1740	0.190	0.44	0.54
172	189	1.1	0.704	6.0	W	1.12	1660	0.186	0.46	0.54
174	224	2.5	0.699	5.9	W	1.19	1620	0.184	0.46	0.54

Sieve analysis of sand and gravel given in Table I.

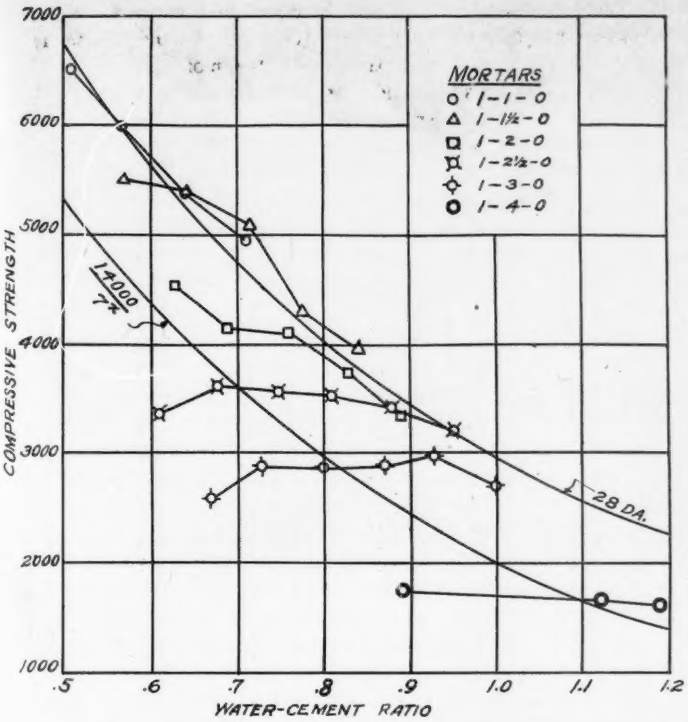


Fig. 4. Compressive strengths of mortars of Series 186

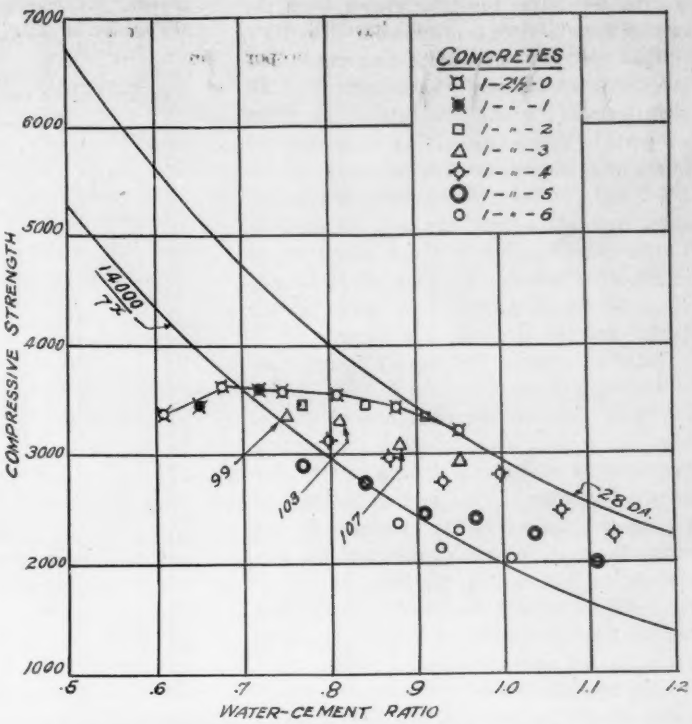


Fig. 5. Compressive strengths of concretes of Series 186

curve represent very sloppy mixtures in which the indicated water ratios call for more water than is actually in the mixtures, and these points should be moved to the left and closer to the curve. When we come to the 1-2-0 mortar we see that the stiffer mixtures show loss of strength. In this case the particle interference is wholly caused by the thickness of the cement film on D_1. In

TABLE III. PARTICLE INTERFERENCE IN CONCRETES
From Series 186 P.C.A. (Elgin sand, F.M. = 3.14; Elgin gravel, F.M. = 7.00, d_o = .650)

No.	Flow	Slump	d	Sacks per yd.	W N	W/C	Comp. str. 28 da.	No. 28-No. 14 d_a	t mm.	Effect. diam. D_1 mm.	3/8-in.—3/4-in. d_a	t mm.	Effect. diam. D_1 mm.
			1-2½-1				a/c = 3.530			(a + b)/c = 4.887			
92	120	0.3	0.761	7.3	N	0.65	3440	0.168	0.50	0.54	0.092	13.0	7.2
94	144	1.0	0.770	7.3	W	0.72	3590	0.171	0.49	0.54	0.093	12.8	7.2
			1-2½-2				a/c = 3.530			(a + b)/c = 6.246			
98	172	2.8	0.793	6.2	N	0.77	3480	0.167	0.50	0.54	0.161	8.4	7.2
102	218	5.3	0.790	6.1	W	0.84	3470	0.166	0.51	0.50	0.160	8.5	7.1
165	240	7.2	0.784	6.1	W	0.91	3350	0.163	0.52	0.44	0.159	8.5	7.1
			1-2½-3				a/c = 3.530			(a + b)/c = 7.602			
99	136	0.5	0.815	5.4	N	0.75	3360	0.165	0.51	0.54	0.214	6.4	7.2
103	156	1.4	0.812	5.3	W	0.81	3310	0.163	0.52	0.54	0.213	6.4	7.2
107	216	5.9	0.802	5.3	W	0.88	3090	0.159	0.53	0.50	0.210	6.5	7.1
112	228	6.7	0.798	5.2	W	0.95	2950	0.158	0.53	0.48	0.209	6.5	7.1
			1-2½-4				a/c = 3.530			(a + b)/c = 8.960			
104	133	0.4	0.833	4.7	N	0.80	3100	0.163	0.52	0.54	0.256	5.2	7.2
108	170	0.5	0.830	4.6	N	0.87	2950	0.162	0.52	0.54	0.255	5.2	7.2
113	192	4.0	0.820	4.6	W	0.93	2730	0.157	0.53	0.51	0.253	5.2	7.1
157	216	5.7	0.822	4.6	W	1.00	2790	0.159	0.53	0.50	0.254	5.2	7.1
117	207	6.5	0.811	4.6	W	1.07	2460	0.154	0.54	0.49	0.249	5.3	7.1
166	230	7.0	0.818	4.6	W	1.13	2220	0.157	0.53	0.44	0.251	5.2	7.1
			1-2½-5				a/c = 3.530			(a + b)/c = 10.320			
105	124	0.1	0.840	4.2	N	0.77	2890	0.159	0.53	0.54	0.288	4.4	7.2
109	134	0.3	0.845	4.2	N	0.84	2740	0.161	0.52	0.54	0.290	4.4	7.2
114	154	0.2	0.835	4.2	N	0.91	2440	0.156	0.54	0.54	0.286	4.4	7.2
158	183	1.6	0.837	4.2	W	0.97	2410	0.157	0.53	0.54	0.287	4.4	7.2
118	195	0.9	0.822	4.1	N	1.04	2240	0.150	0.55	0.54	0.282	4.5	7.2
167	206	5.2	0.830	4.1	W	1.11	1990	0.154	0.54	0.50	0.285	4.4	7.1
			1-2½-6				a/c = 3.530			(a + b)/c = 11.680			
115	144	0.1	0.841	3.7	N	0.88	2360	0.157	0.55	0.54	0.312	4.0	7.2
229	155	0.1	0.851	3.8	N	0.93	2120	0.157	0.53	0.54	0.317	3.8	7.2
159	161	0.2	0.843	3.8	N	0.95	2280	0.152	0.54	0.54	0.312	4.0	7.2
119	171	0.4	0.842	3.7	N	1.01	2040	0.152	0.54	0.54	0.314	3.9	7.2

the 1-2½-0 mixes the interference from the cement film is more pronounced.

This is an interesting mortar. The strength is practically constant for all water-cement ratios, showing that the effect of particle interference is to *neutralize* the effect of a lower water-cement ratio. In the 1-3-0 and the 1-4-0 mixes there is interference from both cement film and bad grading. In these lean mixtures there begins to be interference between the Nos. 48 to 28 and Nos. 100 to 48 groups (not shown in the table) and the strengths are lower.

Table III shows the particle interference in concretes made from the 1-2½-0 mortar of Table II, and the tests are plotted in Fig. 5. It will be noted that the particle interferences of the mortar are carried into all the concretes. This is true as well of the concretes of the other mortars of this series, the particle interferences and the corresponding loss of strength being similar to the 1-2½-0 mortar shown here. In the first two mixtures, the 1-2½-1 and the 1-2½-2, the gravel is not in excess and adds no interference to that already in the mortar. As a result the tests show the same strengths as the mortar, 1-2½-0. With larger proportions of gravel, however, interference is introduced between the groups the No. 4- to ⅜-in. and ⅜- to ¾-in. as indicated in the table where t is less than D_1.

TABLE IV. PARTICLE INTERFERENCE IN CONCRETES

From Series 2G. Mechanically graded from Attica sand and gravel. Slump, ¾-in.

Test No.	Range of sizes	Workable or not	Critical values: Group	d_a	t mm.	D_1 mm.
109	0 to 2-in.	?	¾- to 1½-in.	0.187	15.5	14.2
108	0 to 2-in.	Yes	¾- to 1½-in.	0.148	19.4	14.2
107	0 to 2-in.	Yes	¾- to 1½-in.	0.127	22.0	14.2
100	0 to 1½-in.	No	¾- to 1½-in.	0.382	5.7	14.2
99	0 to 1½-in.	No	¾- to 1½-in.	0.364	6.4	14.2
98	0 to 1½-in.	No	¾- to 1½-in.	0.334	7.4	14.2
97	0 to 1½-in.	No	¾- to 1½-in.	0.306	8.5	14.2
96	0 to 1½-in.	No	¾- to 1½-in.	0.230	12.5	14.2
95	0 to 1½-in.	Yes	¾- to 1½-in.	0.191	15.2	14.2
94	0 to 1½-in.	Yes	¾- to 1½-in.	0.163	17.7	14.2
93	0 to 1½-in.	Yes	¾- to 1½-in.	0.131	21.5	14.2
92	0 to 1½-in.	Yes	¾-to 1½ -in.	0.115	23.6	14.2
75	0 to 1-in.	No	⅜- to ¾-in.	0.245	5.3	7.2
74	0 to 1-in.	Yes	⅜- to ¾-in.	0.192	7.0	7.2
73	0 to 1-in.	Yes	⅜- to ¾-in.	0.162	8.2	7.2
61	0 to ¾-in.	No	⅜- to ¾-in.	0.263	4.7	7.2
60	0 to ¾-in.	Yes	⅜- to ¾-in.	0.220	6.0	7.2
59	0 to ¾-in.	Yes	⅜- to ¾-in.	0.186	7.2	7.2
58	0 to ¾-in.	Yes	⅜- to ¾-in.	0.164	8.1	7.2
48	0 to ⅜-in.	No	No. 4 to ⅜-in.	0.290	2.1	3.6
47	0 to ⅜-in.	Yes	No. 4 to ⅜-in.	0.256	2.5	3.6
46	0 to ⅜-in.	Yes	No. 4 to ⅜-in.	0.228	2.9	3.6
45	0 to ⅜-in.	Yes	No. 4 to ⅜-in.	0.178	3.8	3.6
36	0 to No. 4	No	No. 8 to No. 4	0.296	1.03	1.86
35	0 to No. 4	Yes	No. 8 to No. 4	0.258	1.23	1.86
34	0 to No. 4	Yes	No. 8 to No. 4	0.229	1.45	1.86
33	0 to No. 4	Yes	No. 8 to No. 4	0.200	1.68	1.86
32	0 to No. 4	Yes	No. 8 to No. 4	0.174	1.91	1.86

d_o is assumed to be 0.630.

Table IV contains concretes from Series 2G, made with mechanically graded aggregates by Talbot and Richart, published in Bulletin No. 137, Engineering Experimental Station, University of Illinois, 1923. The entire group with 1½-in. maximum size is given to show changes in t and D_1 from very "harsh" to very workable mixtures. In the other series are shown those which are on the dividing line between workable and unworkable mixes. Where there is particle interference, it occurs only in the coarsest sizes in each group. The strength diagram for this series is given in Fig. 6. It will be seen that as the relative densities of the coarse sizes decrease and before the particle interference has disappeared, mixtures of some of the series become workable and the strengths approach nearly to the true curve. This is because the material passing the No. 100 sieve increases as the coarse sizes decrease, giving an excess of fines which is able to fill up the enlarged void pockets due to particle interference. In the case of test No. 60, where t is less than D_1, there is 19.6% of the sand finer than the No. 100 sieve. I have noticed in other tests that the effects of interference between coarse sizes is largely eliminated in mixtures rich in cement or other fine sizes.

Before closing this discussion, it should be mentioned that the grading of the Elgin sand used in Series 186 would be greatly improved if the material in groups Nos. 28 to 14 and Nos. 48 to 28 could be considerably reduced and this excess added to both finer and coarser groups. The loss of strength due to an overplus in any group was probably first pointed out by F. O. Anderegg while confirming experimentally the mathematical formulas of C. C. Furnas.†

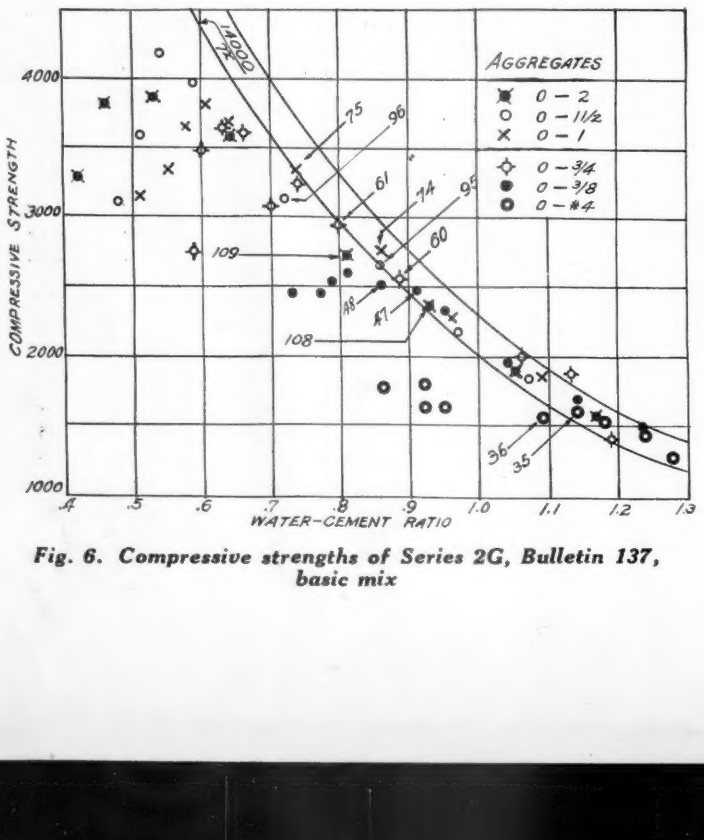


Fig. 6. Compressive strengths of Series 2G, Bulletin 137, basic mix

In a paper necessarily as brief as this, the examples are few and the space insufficient to discuss the practical applications. The main purpose of the paper is to acquaint producers with the destructive effects of particle interference. It is hoped that the importance of the subject to the producer and the user of aggregates has been demonstrated. It is not necessary nor commercially desirable to insist on "ideal" or mechanical gradings. Particle interference can be eliminated, without undue cost, by the reduction of the amounts of those groups that may be present in critical excess, either by "blending," or by the use of various classifiers in the preparation.

Discussion

The problem of the packing of aggregates by the relative sizes of materials has been attacked by Mr. Weymouth from a different angle from that used by us in developing a mathematical, quantitative treatment of the whole problem.*

We were able to develop two sets of gradings: One with gaps in the system which gives the very best packing when special methods of application, such as vibration, are available to overcome the harshness of the system. The other, where the sizes are present in such a manner that, when separated by standard sieves, each fraction

†Anderegg, F. O., Ind. and Eng. Chem., Sept., 1931.

*Grading Aggregates, Ind. Eng. Chem., Vol. 23, p. 1052 to 64, Sept., 1931 (abstracted in ROCK PRODUCTS, February 13, 1932).

should be about 1.2 times the amount of the next smaller, gives a mix of fine workability. This was demonstrated experimentally with mortars and considerable work has also been done on its successful application to both cement and to concrete, although the results have not yet been published.

The method of Mr. Weymouth, to show which sizes are present in too large quantities, can be simplified by plotting the cumulative per cent. passing (or retained on) each member of the standard set of sieves, where the sieve numbers 100, 50, 30, etc. (this corresponds to the logarithm of the dimensions) are plotted at equal intervals along the axis. Any appearance of a "Critical *t*" as in the line 6 of Table I causes a "hump" in the grading curve.

Mr. Weymouth has made a valuable suggestion as to the effect of consistency in determining the amount of cement paste adhering to the surface of the aggregates and of the resultant effect on the size of the finer fractions especially.

Physical laws do govern the packing and workability of aggregate and the sooner these are appreciated and applied the sooner will the design of concrete be truly scientific. Mr. Weymouth is to be commended for his contribution towards this end.

F. O. Anderegg.
C. C. Furnas.

Pozzuolanic Materials and Blended Cements

OUR KNOWLEDGE of pozzuolanic materials has been greatly increased by a paper by Professors Hughes and Levens of the University of Minnesota in a recent issue of the *Journal of the American Concrete Institute* and discussions which followed it.

All adopt Cowper's definition of a pozzuolanic material, which is, in effect, a material which will form stable and insoluble compounds with free lime at ordinary temperatures, and that these compounds will resist the usual disintegrating agencies.

Hughes and Levens tested two kinds of volcanic ash (pumice or pumicite), ground slag and burned clay. Other materials mentioned in the discussion are European trass, powdered silica, Santorin earth and Italian pozzuolana, which would seem a sufficient variety. In Hughes and Levens' tests the materials were substituted for part of the cement, that is, mixed with the cement to form blended cement, and two brands of cement were used. In the others the use of pozzuolanas as admixtures, added to the cements in certain proportions, was described.

None of the blended cements used by Hughes and Levens showed as high strengths at 7 days as plain cement when mixed in 1 : 3 sand mortars. At 28 days and 90 days slag and burned shale gave higher strengths with continued wet curing. With 6 days under water and the remainder of the time in air the strengths were all lower than with plain cements, and some gave only 42% and 44% of the plain cement mortar strengths. This was where 30% of the pozzuolana and 70% cement were used. There was also noted a considerable difference in the effect of pozzuolanas on the two brands of cement. The amount of water required for blended cements was in excess of that required for plain cement. The materials which made the best showing had the greatest volumes when mixed with hydrated lime and water.

The results as to early strengths agree with the results given by Mr. Tuthill, but he carries on his tests to 3 months and 6 months, at which ages all the blended cements, with 10%, 20% and 30% pumicite, gave equal or higher strengths than plain cement. His tests were made on concretes with 3-in. maximum size coarse aggregate. The strength ratio for plain cement for 28 days and 6 months was 1 : 1.22, and with 30% pumicite (blended cement) the ratios were 1 : 1.78 Mr. Tuthill says that the extra strength comes from the union of free lime in the cement with the pumicite. He quotes from European authorities to show that they generally hold this view. One investigator, Manonilov, of the Moscow Institute of Transportation Engineers, shows that the decay of concrete from sea water and ground water action is due to the formation of $Ca(OH)_2$ and magnesium salts in setting, which are easily soluble, and that the best remedy found has been the addition of pozzuolanic materials which contain active silica that combines with the lime hydrate to form insoluble compounds. Russian docks made of Teil lime and Roman pozzuolana withstood sea water action completely, while portland cement concrete docks began disintegrating in 7 years and were destroyed in 25-30 years.

Mr. Tuthill concludes that centuries of experience with pozzuolanic materials have demonstrated the protection that such materials afford and he also concludes that we have in America materials that are equal or superior to those used in Europe.

Mr. Lea says that his researches have shown artificial pozzuolanic materials are better than such natural products as pumice and trass. He prefers a selected clay burned at a predetermined temperature and ground to pass 180-mesh. This shows a high activity by his conductivity test and (like the spent shale from Scotch oil-shale kilns) makes a high-strength mortar when mixed with hydrated lime and sand. The results of Hughes and Levens on pumices agree fairly well with his own results on trass and similar products. With burnt clay, however, all amounts of substitution down to 40% cement, 60% burned clay, gave higher tensile strengths at 1 year than plain cement. At 7 days the strength was less and at 28 days about equal.

The results found by the California Division of Highways are given in several tables in Mr. Stanton's paper. In general the results on blended cement made with pumice, pumicite, trass and silica dust seem to bear out pretty well the work of Hughes and Levens, that is, all amounts of these used as *substitutes* gave lower strengths than plain cement. When used as *admixtures,* that is, in addition to the plain cement, the strengths were all higher, and in some cases very much higher. The greatest differences were shown in lean concretes. In one series the standard mix was 1 : 3.00 : 5.39. With additions of 10%, 20% and 30% pumicite the strengths at 1 year were 126.7%, 139.4% and 150.2% of the plain cement concrete strength. With substitutions of the same amounts the strengths were 103.9%, 85.2% and 73.6% of the strength of the plain cement concrete. Cores drilled from pavements 2 years old made with blended cement showed strength ratios of 101.3, 99.1, 95.3, 97.9 compared with plain cement, corresponding to substitions of 30%, 15%, 10% and 20% of pumicite.

Shrinkage in drying and volume change with blended cements was studied by Hughes and Levens, and a large part of their paper is given to tables and graphs of their results. They found that shrinkage during initial drying was a little greater than with plain cement, but the difference was not much and there were two exceptions. Apparently the difference in volume change is not important.

A summary of the opinions and conclusions of the papers might be something like this: Pozzuolanic materials have a real value, especially where they can be kept wet a long time and where concrete is likely to be attacked by sea water or ground water. Their effect is due to the active silica combining with the lime that is free in the cement or that is liberated in the setting process. Experience has shown the compounds so formed (which are really cements) to be stable and insoluble. But different materials vary widely in pozzuolanic activity, and their effect varies with different cements. Blended cements give lower strengths at early ages, but some of them at least give higher strengths after 6 months or 1 year. The tests show some artificial pozzuolanas to be more active at early ages than natural products.

No attempt was made to explain any increase of strength on any but chemical grounds, but it may be remembered that the work of Furnas and Anderegg on grading has shown that admixtures may considerably increase strengths of concrete by making the grading curve smoother, or may decrease it, depending on the distribution of particle size of the cement itself.

Opportunities for Using Indicating and Recording Control Instruments in the Rock Products Industries

Part XI—Instrumentation in the Ceramic Industry (Continued from November 5, 1932 Issue)

By James R. Withrow*
Chairman, the Chemical Engineering Department, Ohio State University

In the brick industry the principal need of instrumentation outside the power plant is in connection with the drying and burning of the brick. If bricks are dried too rapidly they will crack and be weak. If they are dried too slowly the process takes too long and labor and fixed charges are too high. The temperature and humidity in the dryer must be kept at such a point as to ensure the fastest drying compatible with the production of perfect brick. The instruments used in the drying operation are usually recording thermometers and recording hygrometers, or two recording thermometers, one for wet bulb and the other for dry bulb temperatures.

In burning the brick the temperature must be regulated closely to follow a definite cycle which experience has shown to be best. It is therefore necessary to provide a suitable instrument for controlling, recording or indicating the temperature of the kiln. As the temperatures involved are very high, the type of instrument used is the pyrometer. One could hire six watchmen and they could all sleep at the same time, but the instrument is always awake. Instrumentation records accurately the temperature of each kiln and serves as a guide to the fireman and results in improved quality of the brick produced.

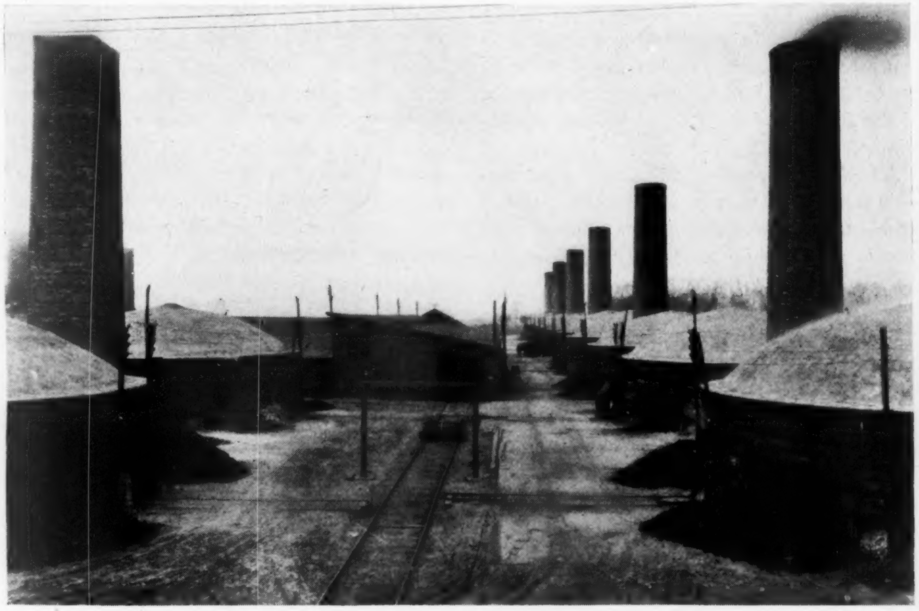


Fig. 57. Illinois brick plant with periodic kilns equipped with pyrometers

Fig. 57 shows the general arrangement of periodic round kilns at an Illinois brick plant where several recording multiple-point pyrometers were installed. With these instruments a complete record of all kilns under fire from start to finish is possible. This enables the acceleration of the burning period without danger of overburning the ware, especially the top, and eliminates soft kiln bottom, which gives a better quality tile throughout the entire kiln. The officials of the plant said that the only cost for pyrometer equipment during several years has been recording charts and some protecting tubes. Today it would be impossible to burn without pyrometers.

Fig. 58. Temperature recording instruments at a Texas brick plant

Fig. 58 (courtesy Leeds and Northrup Co.) illustrates a pyrometer installation at the Thurber Brick Co., Thurber, Tex. Because of this centralized battery of potentiometer recorders which tell the superintendent instantly of temperature conditions of all kilns at the same time, a better and more uniform product is obtained. The brick plant finds that the investment in instruments pays. In firing brick or other heavy clay wares, the periodic kilns employed are usually so large and the mass of ware is so great that much time is lost in endeavoring

*The author is indebted to Dr. Wei Yang, the Harrop Ceramic Service Co. and the Engineering Experiment Station of Ohio State University for assistance in the preparation of this paper.

to secure a uniform temperature throughout the ware setting.

With the introduction of kilns like the Harrop car tunnel kiln, the mass is relatively small and every piece of ware is within easy reach of the heat coming from the successive furnaces. Thus there is very little delay in the heat reaching the center of the car setting. The result is that the firing time is reduced to a minimum and a uniform product assured.

Dry press brick, for instance, are set directly on the kiln cars, using a gravity conveyor and eliminating the helper or tosser. In this way the brick are touched but once from the time they are formed until they are fired and cooled, and kiln labor is greatly reduced. Upon being discharged from the dryer, and while still at a temperature of approximately 250 deg. F., the cars of ware are transferred to the tunnel kiln for firing.

As the ware proceeds through the tunnel, heat is applied through uniformly-fired furnaces along both sides, and a thoroughly matured product is the result. The maximum temperature of the ware generally varies from 1850 to 2570 deg. F. Any or all types of fuel have been successfully used, including natural gas, city gas, producer gas, mechanically-stoked coal, hand-stoked coal, pulverized coal, and fuel oil.

Fig. 59 (courtesy Harrop Ceramic Service Co.) shows a hand-stoked coal furnace section of a Harrop kiln in a fire brick plant at St. Louis, Mo. The return track is shown at the right and a car loaded with fire brick in the distance. The pyrometers in the furnace arches and their connections are shown over each furnace.

Fig. 60, showing a car loaded with green brick at a large fire brick plant at Salina, Penn., indicates the construction of the car, the heavy refractory block platform resting upon a bed of heat insulating material to protect the semi-steel cast frame. The pyrometric cones are also shown. Usually three sets of cones are used; at *A*, *B*, and *C*, as marked. The cones before firing are shown placed in proper position, while two sets of cones after firing are placed on the platform. At *A* the temperature is between cone 11 and 12 (between 2464 and 2498 deg. F.). The temperature at *B*, as well as at *C*, is between cone 12 and 13 (between 2498 and 2534 deg. F.). Thus they show at a glance the approximate temperatures of the ware in the furnace and serve as a check on the record made by the pyrometers, though they only give not one exact temperature but a small range of high temperature reached in the furnace.

The plant of the Standard Tile Co., Zanesville, Ohio, is a good example of the use of instrumentation. Here controls were installed to regulate the unstable factors affecting the heat balance and keep the temperature on a straight line. Fluctuations are checked before they can upset the heat balance and a uniform temperature is maintained. With the installation of this control instrument it was possible to save $200 per month on fuel alone and in addition the percentage of No. 1 ware was increased 5% and the rich, beautiful colors were thoroughly and uniformly fired. The loading of the car may vary as much as 75% without affecting the thermal balance.

Pottery Manufacture

Instruments are also vitally important in the efficient production of pottery ware. The president of a large pottery plant in Ohio stated that he did not believe a tunnel kiln could be operated without pyrometers. Their equipment enables them to read temperatures from 14 points in the kiln and to read continuously from four points. The firing temperature is 2375 deg. F. It would be a very difficult job to fire the kiln with any degree of accuracy without the instruments, and spoilage of ware would be increased considerably due to uneven firing.

Pyrometers were installed in the glazing department of a large tile works at Indianapolis, Ind. Accurate temperature control is very important in glazing, as it takes longer to finish the charge and the operating cost is increased if the fire is allowed to drag. If the temperature in all parts of the kilns is not treated evenly, there is danger of it running too high and this results in overburning the tile. Accurate control is especially difficult because the heat process of the glaze work is done at night. Here the pyrometer furnishes an absolute check on the operations of the kiln by showing what the operating temperature was at all times.

It is definitely established that the pyrometer installation has effected a saving of coal in the glaze department. This saving is due in part to the fact that the night man knows the recorder will tell the tale if he does not fire correctly. Consequently he fires carefully so as to keep the chart line as smooth as possible. Another saving results from the fact that the pyrometer makes it unnecessary to guess when the kiln needs firing. Guesswork results in coal being put on the fire when it is not needed.

Although only one or two glazing kilns are operated at a time, the daily fuel saving is 1½ to 2 tons. Taking the lower figure as an average, the pyrometer saves 450 tons of coal each year. At $5 per ton this amounts to $2250 annually, which means that the pyrometer pays for itself in a little over three months in fuel saving alone.

The saving in spoilage, while not accurately known, is certainly an important item. Since the installation of pyrometers there has been no overburned or spoiled ware because of inaccurate temperature control. The importance of this is best stated by saying that a charge of 13- by 6-in. wall tile contains about 28,000 pieces. A spoiled batch not only entails a large loss in the value of the material but it also means a loss in overhead and productive labor.

The pyrometers also save a considerable amount of the foreman's time. Since the instruments are located in his office, he need not go to a kiln to know how it is being fired.

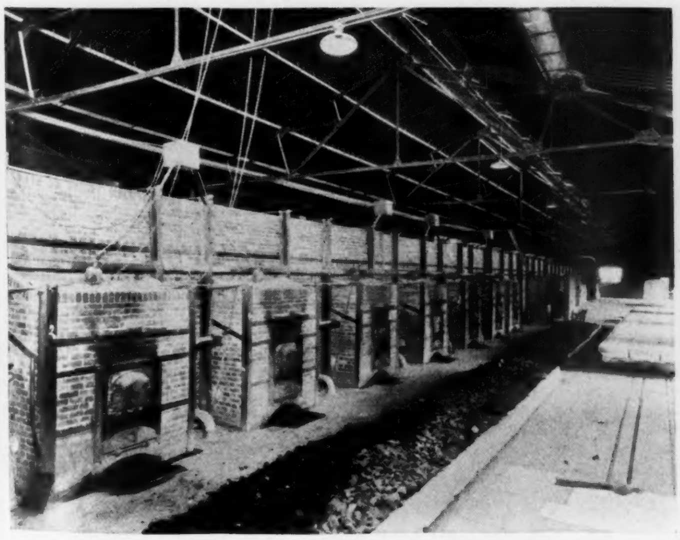


Fig. 59. Furnace section of hand-stoked tunnel kiln

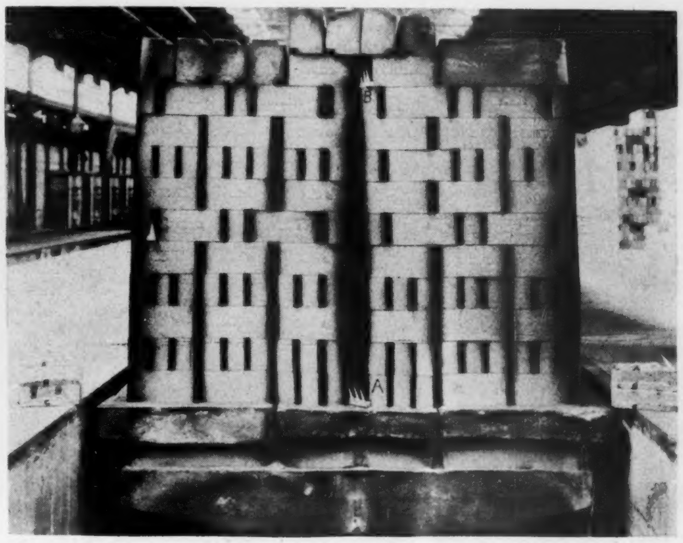


Fig. 60. Car of green firebrick ready to enter tunnel kiln

The pyrometer tells the story. While not displacing any labor, the time saved enables the foreman to give closer attention to other duties. As a result of the use of instrumentation in glazing kilns, one company reports a reduction of burning time from six to four days, another reports a saving of 14% in fuel, another reports a reduction of burning time of 24 hours, a fourth reports a reduction in coal consumption from 30 tons to 17 tons for making 300,000 brick.

As a result of careful control through the use of instrumentation, a more uniform product with a larger percentage of No. 1 ware is obtained. There is a labor saving of about 40% over former periodic kiln practice. There is also a fuel saving of about 85% over periodic kiln practice. Due to the fact that the firing time is faster than in the periodic kilns and that it is possible to single-fire the ware, production is speeded up considerably. Only about one-third of the number of saggers used in the periodic kilns are necessary with the tunnel kiln for the same production, and the actual saving in sagger breakage is approximately 25%.

Clay Pipe Manufacture

Clay pipe, like brick, is made of clay and must be dried and burned properly. At a large pipe plant in St. Louis, Mo., 36 kilns were operated, all equipped with thermocouples to record the temperature at the top of the kilns. The temperature in each kiln is shown by three indicating pyrometers, each of which is provided with a switch having contact points for 12 kilns. In the office four recording pyrometers with duplex charts give a continuous record of the temperatures in eight kilns simultaneously. The maximum temperature is between 2250 and 2300 deg. F. and the temperatures of all kilns are recorded by the burners every hour. These readings are checked by means of the master instrument in the office, to insure the recording of correct temperatures.

Pyrometers give a better idea of what is happening in the kiln. Burning ware without instrumentation is like walking in the dark. By using pyrometers, excessively rapid temperature rises and other troubles are detected more quickly and steps may be taken at once to remedy the difficulty. The pyrometers are of the greatest advantage during the "water-smoke" because the information they give enables one to secure the gradual temperature rise which is so important in preventing spoilage of ware. Too rapid heating causes cracking and blowing, and the instruments have proved very helpful in reducing spoilage and waste.

Insulator Manufacturing

Another example of the importance of instrumentation is shown in the insulator manufacturing division of a large electric and manufacturing company at Derry, Penn. In the manufacture of high voltage insulators careful firing and accurate maintenance of correct temperature schedules are of the utmost importance. If the firing temperature is too high or too low the structure of the porcelain becomes spongy, making it unfit for electric insulation. The least porosity will permit the absorption of water and may cause serious troubles and damage. In the underfired case the ware has to be fired again. If the temperature drop is corrected immediately the ware may come out all right, but the completion of the burn will be delayed. Thus both quality and economy require careful watching and prompt, accurate adjustment of the burning temperatures.

Fig. 61 (courtesy Brown Instrument Co.) gives a side view of a Harrop kiln equipped for burning either oil or gas in the manufacture of insulators. The thermocouples are on top of each furnace.

Fig. 62 is a view of the top of the kiln and shows the location of the thermocouples.

Fig. 63 is a view of the charging end of the kiln and the electric pusher in operation. With this Harrop kiln and the temperature control instrument the plant is now producing as much ware in one day as was formerly burned in a week in a 15½-ft. circular kiln. At the same time fuel consumption has been reduced to 30% of the previous requirement.

Low-tension electric insulators were manufactured by a large porcelain plant at Parkersburg, W. Va. A Harrop continuous kiln was used for firing and the temperature required was from 2400 to 2500 deg. F. The various parts were fired satisfactorily by increasing or decreasing the temperature to suit the respective bodies, or by increasing or decreasing the speed of the cars going through the kiln. The kiln is 321 ft. long and holds 52 cars. On each side of the kiln are four furnaces equipped for gas firing through Maxon burners. Complete equipment for oil burning is also at hand, so that the change from gas to oil can be made quickly at any time.

In Fig. 65 (courtesy Harrop Ceramic Service Co.) there is shown at the right a multiple-point recording pyrometer inclosed in a dustproof case. At the left of the instrument board are shown two 18-point switches, and on the top of the switches is shown a double range indicating pyrometer to indicate all temperatures on the kiln. A rack containing a number of sliding blocks is shown at the top of the instrument board, to give a visible log of the stage of manufacture of each car.

Fig. 64 (courtesy Brown Instrument Co.) shows the Harrop kiln used in the Square D insulator plant. The charging end of the kiln is shown at the left with a car loaded ready for charging. The draft fan is shown by the side of the kiln. Another loaded car is shown on the return track.

Conclusion

In this discussion we have carried the question of instrumentation and its advantages to the rock products industries, for ceramics is built upon rock products. The chemistry of the ceramic industry is closely related to both the lime and cement industries. In fact, the whole matter of drying in the ceramic industry is closely related to the

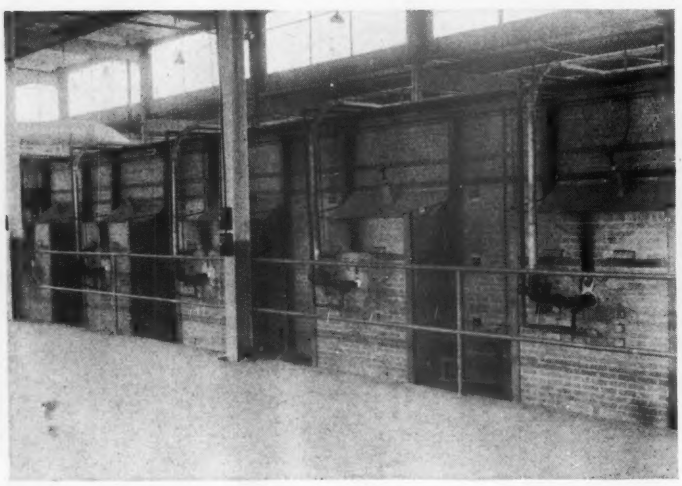


Fig. 61. Furnace section of tunnel kiln equipped to burn either oil or gas

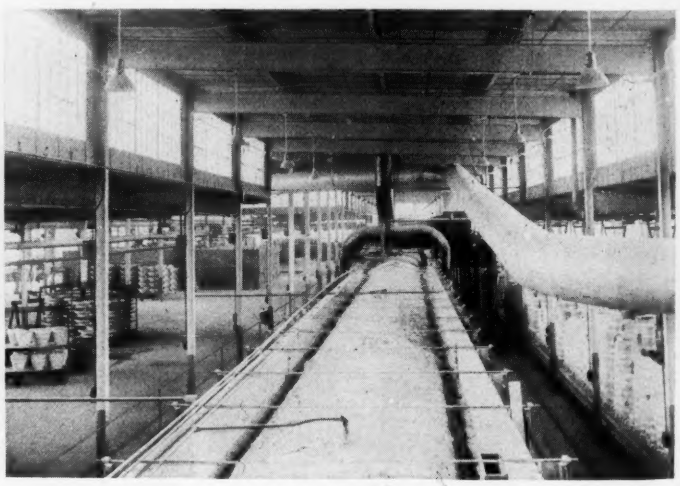


Fig. 62. Top view of same tunnel kiln, showing location of thermocouples in roof of kiln

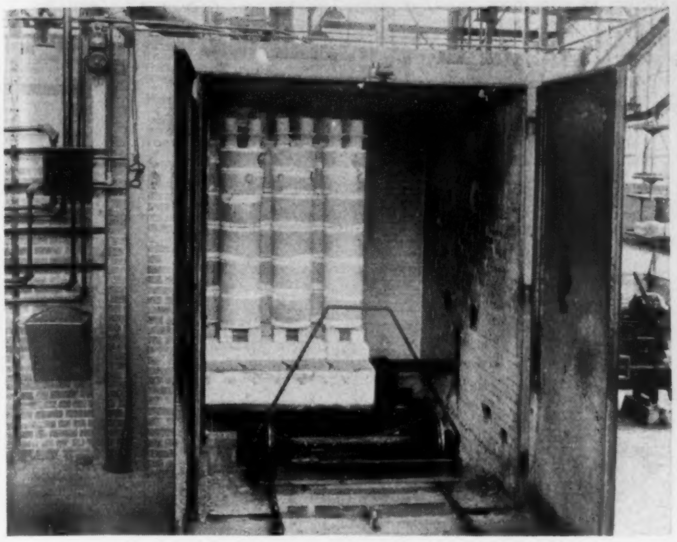


Fig. 63. Charging end of tunnel kiln with electric pusher in operation

Fig. 64. Charging end of tunnel kiln with loaded car ready for charging

problems of the gypsum industry, except that the latter are simpler.

Whereas 25 years ago the ceramic industry was in a condition not much advanced over the time when the children of Israel made brick in Egypt, modern mass production has compelled the adoption of instrumentation which has been so profitable in other industries. As a result the ceramic industry today has scarcely a plant which would care to go back to conditions where all responsibility for temperature control was upon the shoulders of the superintendent or manager and the most skilled workers they could procure. As a result, the ceramic industry feels that its profits have been greatly increased. In many cases the rising cost of production, coupled with lower selling prices, would have driven many companies to the wall had it not been for the increase in efficiency through the use of instrumentation. The development of instrumentation has increased the use of tunnel kilns so that everything is now made in them, from bricks, drain tiles, sewer pipes, high-grade chinaware or porcelain, small electrical insulators and spark plugs to the insulators for high-tension lines. This has been made possible only by accurate temperature control through instrumentation.

(To be continued)

Effect of Crimped-Paper Ends in Propagating Detonation

ABILITY of crimped-paper ends on cartridges of permissible explosives to propagate detonation across an air gap to another explosive charge is discussed in a report of investigation on this subject by the Bureau of Mines.

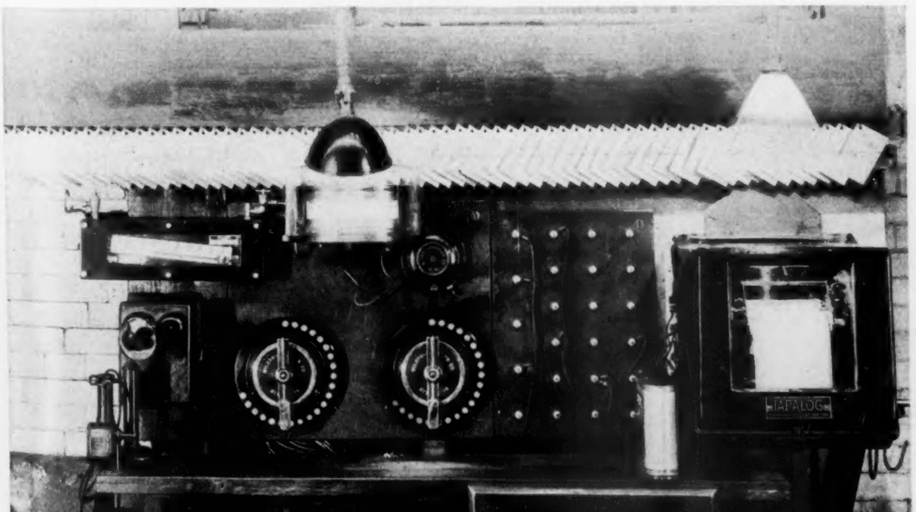


Fig. 65. Indicating and recording instruments which show temperatures in a tunnel kiln

Minor Metallic Constituents of Phosphate Rock

WHILE mineral fertilizer materials consume the largest volume of phosphate rock and its value for this purpose is dependent primarily on its content of phosphoric acid, the content of other substances influence the desirability of a particular rock for commercial purposes. A recent article in *Industrial and Engineering Chemistry* discussed the occurrence in domestic phosphate rock of metallic elements other than calcium, iron and aluminum. Methods of analysis were outlined and several properties discussed.

It was said that in general the magnesium content, the titanium content and the manganese content of a particular type of rock tends to decrease as the phosphate acids tend to increase. It seems likely that potassium and probably a portion of the sodium in phosphate rock are present as complex silicates.

Manganese is found in small quantities in all phosphate rock tested. Chromium is found in much greater percentages in western phosphates, although the form in which it occurs has not been determined. Small quantities of copper, vanadium and zinc were found in many of the samples tested.

With the exception of potassium and sodium, the metals discussed were found in quantities of less than 0.5%, usually considerably less than this. Arsenic was found in some phosphate rock and commonly occurs in oceanic clays, river silts and igneous rocks.

Constitution of Coal from Walker County, Ala.

CARBONIZING properties and constitution of Black Creek bed coal from Empire mine, Walker county, Alabama, are reported in technical paper 531 by the Bureau of Mines.

Should a Crushed Stone or Gravel Operator Make or Buy Electric Power?

By Chester Reed Earle

WHAT IS the most economical way of securing electric power for the operation of a crushed stone plant? Can such a plant afford to install equipment to make its electric power or is it cheaper to buy it from the public utility company or will a combination of the two methods yield the lowest power cost?

This is a particularly important question in these days when executives are scrutinizing the cost of every part of their operation to determine whether or not it is being done economically. The problem has become more important in the crushed stone and gravel industries because of the rapid growth during recent years of the motor drive for crushers, screens and auxiliary equipment.

Much discussion could be avoided if engineers could give a definite answer that would cover all possible cases, but no such general answer is possible. The average competent, unprejudiced power engineer believes that generalizations are dangerous and prefers to analyze each case on its own merits.

Items That Affect Power Cost

Let us consider some of the items that will affect costs if the crushed stone plant installs its own power generating equipment. In addition to the tangible costs there will be certain intangibles that will materially affect the situation. How important is reduction in power cost, considering the investment necessary to attain a reduction? Could that investment be more profitably made in production equipment? Does the management wish to maintain complete independence? How important is continuity of service and is there any question as to the reliability of the power service offered by the utility company? And so on. Each executive will doubtless think of other intangible factors, difficult to express in dollars and cents, that affect his own case.

Analysis of all the tangible and intangible costs of building and operating an isolated power plant can be made by competent engineers. Then the cost of power purchased from the local utility company can be compared with it, all the factors weighed, and a sound decision reached.

The factors to be considered in studying the problem are: probable investment cost, importance of continuity of service, load factor, fixed charges, operating costs, types of fuel available and methods of utilizing them, and water available. Continuity of service and load factor will influence the number of generating units and the proportion of emergency or standby generating capacity that would have to be provided.

Fixed charges include interest, amortization to cover depreciation and obsolescence, taxes and insurance. The percentage that should be allowed for these charges is often the subject of much controversy, especially the factor of obsolescence. For many types of industrial equipment, the policies of nearly 200 concerns require that the savings produced by the equipment should return the initial investment in savings within five years at most and in many cases in a shorter period. It is obvious that fixed charges allotted on this basis are computed on the economic life of the equipment rather than on its physical life.

In analyzing proposals for a power plant the operator should decide whether he is to calculate his fixed charges in this way or whether the conditions of his particular business warrant the usual fixed charges of from 14 to 17% commonly used in calculating power costs. In comparing the cost of installing a power plant with the cost of purchased power this question is usually raised and the intangible factors in the case may affect the method of computing the fixed charges.

Power Factor—Load Factor

Power factor, as well as load factor, will have an important bearing on the decision. If the power factor is low (40 to 50%) as it has been found in many crushed stone plants, it may be advisable to install capacitors or synchronous motors to raise it. With a low power factor, to be compelled to supply 1.5 or even 2 kw. to the transmission system and motors in the plant for every 1 kw. actually utilized means the installation of greater generating capacity either in the isolated plant or in the central station. The power charges of the latter will take the low power factor into account, as it increases the investment in equipment. The isolated plant must take it into account in exactly the same way. For a discussion of power factor correction and equipment, the reader is referred to Rock Products, April 12, and May 10, 1930.

Load factor, as contrasted with power factor, is the ratio of the average load to the maximum load over a certain period of time. The average load is taken over a certain interval such as a day, a month or a year and the maximum is taken over a short period, such as 15 min. or an hour. The interval must be definitely specified; it depends much on local conditions and on the purpose for which the load factor is to be determined. A power plant with a high load factor usually has a few large units and the most economical equipment will quickly pay for itself. A low load factor usually necessitates smaller units and a larger number of them and the economy of at least half the units may not be of great consequence.

The foregoing are some of the factors that must be considered by the management before any attempt can be made to decide what type of power generating plant can be installed or whether the power is to be purchased. Needless to say, these points should be carefully gone over with a competent engineer as well as with the representatives of the public utility company.

A Typical Example

Let us assume that we have a crushed stone plant with installed motors of about 1000 hp. or 750 kw., a yearly load factor of, say, 40% and a power factor of 90%, and let us examine some of the types of power plant that might be installed to supply this load.

It might appear that not much economy would result from installing a small steam plant using noncondensing engines or turbines, but this conclusion should not be accepted without further investigation. One important factor that might make such a plant feasible is the type of fuel available and the possibility of burning it under boilers economically.

Coal, fuel oil and natural gas are now in competition in certain parts of the country. Sometimes all three are available at low cost, sometimes one or two of them. It may even be possible that, with cheap fuel and other local conditions just right, a steam engine or steam turbine generating plant could be installed that would supply just the right amount of exhaust steam to the heating system in winter, making just the amount of power to balance that exhaust and buying any power that might be needed in excess of that amount.

This has been done successfully in some industries, although many engineers would probably decide that the heating load of a crushed stone plant might be too small to warrant the rather complicated layout of heaters necessary. The scheme is mentioned, however, to illustrate the point that even though there is no demand for process steam, the possibility of using non-condensing prime movers may be worth considering.

If it can be clearly shown, however, that a non-condensing steam plant is not feasible, consideration can then be given to the condensing steam plant, the Diesel engine plant, the gas engine plant and even the hydro-electric plant.

Many engineers feel that well-designed isolated power plants can be built now under conditions that will show low obsolescence and will result in worth-while economies when business improves. The public utility companies, of course, can take advantage of these same factors and may be able to adjust rate schedules to meet this competition.

Comparative Costs of Power Plants

Published data on steam plants up to 1914 show that for reciprocating steam engine plants the plant first cost was about $115 per kw. and the operating cost about 2 c. per kw. hr. For steam turbine plants the plant first cost was about $75 per kw. and the operating cost about 1½ c. per kw. hr. These figures do not include fixed charges, which could be easily estimated on the basis noted above. Data on gas engines operated on producer gas at that time showed a plant first cost of about $150 per kw. and operating costs of about 2 c. per kw. hr.

The widespread development of natural gas and oil pipeline systems during the past few years might give a supply of pipeline gas at an attractive price. One might, therefore, be led to consider the use of natural gas engines or the burning of the gas under boilers to make power at low cost. In any event, the use of gas for boiler fuel and for the gas engine has assumed new importance in certain sections of the country.

Because of the small heating load ordinarily required by a crushed stone plant, the proponents of the Diesel engine advocate it as the ideal prime mover for driving electric generators in such plants. They point out that by proper use of heat otherwise wasted in the exhaust or in the jacket cooling water, buildings may be heated without burning additional fuel under boilers. They call attention to the high thermal efficiency of the engine, the convenience of burning and handling the fuel. They compare the small amount of water needed for cylinder cooling with that demanded by a condensing steam plant. They claim absence of standby losses, ability to start quickly, improved mechanical design, higher speeds making for better generator design and performance and a host of other advantages.

Certainly these claims deserve serious consideration. When properly designed and built, equipped with proper accessories, such as air filters, mufflers, controls, properly treated circulating water and so on, to help reduce maintenance, Diesel engines have given good service in many industrial power plants. Proper supervision by well-qualified operators is essential. The subject of circulating water deserves attention, especially when a comparison is to be made between the costs of steam and Diesel plants, for if the Diesel cooling water must be treated or a cooling tower installed, those things will influence the comparison.

Diesel Engine Generating Units

The automatic Diesel generating plant, if it develops successfully along the lines of the pioneer installation, may lead to some interesting economies by decreasing the items of labor and supervision. As to the investment costs for Diesel engine plants, a gradual decrease seems evident and many of the same factors apply as for steam equipment. A comparison of steam and Diesel engine costs for a 1000 kw. installation showed a plant first cost of $153 per kw. for the Diesel engine plant and $110 per kw. for the steam plant. The operating costs per kw. hr. were as follows:

	Diesel	Steam
Direct cost	$.0046	$.0085
Fixed charges	.0048	.0029
Total cost	$.0094	$.0114

Based on oil at 3 c. a gallon and coal at $2.50 a ton, the Diesel plant showed an estimated saving over the steam plant of about $8800 a year. Under different conditions, however, with cheap coal and with oil at a higher price as it might be in certain sections of the country, production costs for the Diesel plant might exceed those of the steam plant.

As an example of present costs of installing a Diesel plant, a 1200-hp. two-unit Diesel plant in November, 1930, cost $110 per kw. This price was for the complete plant, including building, foundations, fuel storage and handling, cooling water equipment with softener, piping, switchboard, wiring and all accessories, and included an engineering fee of 5%.

Recently published data on the costs of Diesel engine plants of 800 to 2400 kw. size installed between 1925 and 1930 showed first costs ranging from $95 to $195 per kw. with an average of $140 per kw.

The latest report, 1931, on Diesel engine power costs, issued by the general power committee of the N.E.L.A., shows total operating costs, exclusive of fixed charges, ranging all the way from 1 to 2 c. per kw. hr. In using this data, of course, the load factor and many other operating conditions must be known and studied in order to arrive at probable costs.

Conclusions

The above outline may serve to show the influence of some of the more important factors to be considered in trying to decide how to get electric power as cheaply as possible. After some sort of an approximation of the cost of installing and operating his own power plant, the operator is then in a position to secure data from the public utility company on the cost of purchasing the needed service.

As pointed out above, the management should consider carefully how soon it must get its investment back from its own power plant. The public utility will stress that point as good engineering economics. The charges for purchased power take that factor into account, as well as load conditions, diversity, maximum demand, power factor and a great many other conditions. The competition is keen between the public utilities and those interested in establishing small industrial power plants and only by careful engineering analysis can the best solution of the problem be obtained. It is to the credit of the power engineers of the country that the trend of power cost is steadily downward and that whether you make your power or buy it, an arrangement can be worked out that will give maximum kilowatt-hours for every dollar spent.

Construction Management

THE elements entering into the successful handling of construction work are discussed in a new book, Economics of Construction Management, by J. L. Harrison of the U. S. Bureau of Public Roads. This 325-page book, published by the Gillette Publishing Co., Chicago, Ill., is the result of the author's 25 years of active contact with the construction industry and of studies made by him for the Bureau of Public Roads.

Some of the subjects included in the 22 chapters are: financing, bidding, planning the work, purchasing materials, hauling, cost keeping and management methods, financial statements, etc. The importance of good management and correct planning and execution of the work is stressed and the advantages of central management over job management are set forth.

The author believes that poor results are generally due to poor judgment or incorrect planning in the central office and that the central office must properly assume the responsibility for the work. Since construction work is a succession of related operations, best results are obtained by holding to a production rate which will balance the various operations.

Methods of handling and paying labor and analyzing production results are discussed. Cost records, proper distribution of direct production costs and other expenses, methods of dealing with depreciation of equipment and accounting methods are discussed. The use of graphs to show production factors is also illustrated.

Simplified Practice for Wheelbarrows

A BULLETIN giving the simplified practice recommendation for wheelbarrows, which recommendation became effective on April 1, 1932, has been issued by the division of simplified practice of the Department of Commerce. The number of sizes and types of wheelbarrows has been reduced to 27 by this new recommendation.

The Recast Analysis and Its Relation to the Chemistry of Portland Cement*

Part VIII—Computation of Portland Cement Raw Mixtures

By Louis A. Dahl
Research Chemist, California Portland Cement Co., Colton, Calif.

IN THE preceding discussion of the application of the recast analysis to problems pertaining to phase equilibria, it was found to be an advantage to start out with a study of the ternary system, and to develop principles which could be extended to systems involving more than three components. In considering the mathematical principles involved in the computation of portland cement raw mixtures the same plan will be followed. By starting out with a study of ternary mixtures it is possible to develop the subject both graphically and mathematically, so that the reader may visualize the various steps involved in the computations.

Portland cement raw materials contain a considerable proportion of volatile material, such as carbon dioxide and moisture, which are removed in the process of calcination. Such materials may, however, be considered on an ignited basis both as to weights and composition. The procedure in any computation in which it is desired to calculate proportions of raw materials to make a predetermined clinker composition is to calculate the compositions of the raw materials to an ignited or clinker basis, compute the proportions required, then convert these proportions to an unignited basis. In order to simplify the early part of the discussion of principles it will be assumed that the various materials involved consist only of CaO, Al_2O_3 and SiO_2, and that there are consequently no volatile constituents present.

In the computation of proportions of materials it is a good plan to express the proportions of the materials in terms of fractional proportions rather than percentages. For instance, if four parts of limestone are mixed with one part of clay, the mixture consists of 80% of limestone and 20% of clay, or it may be said to consist of 0.80 parts of limestone and 0.20 parts of clay. The latter form of expression is preferable, for reasons which will be apparent when methods of computation are presented. It should be noted that the sum of the percentages of materials entering into a mixture is 100, and that the sum of the fractional proportions is 1.00. After the computation is completed the results may be expressed in terms of percentage, if desired, by multiplying the fractional proportions by 100.

As a basis for our computations, let us assume that we have three materials, *A*, *B* and *C*, of the composition indicated in Table 3. It is assumed that these are combined to form a mixture in which the fractional proportion of *A* is *a*, the fractional proportion of *B* is *b*, and the fractional proportion of *C* is *c*. The composition of the mixture is shown in the column headed "Mixture."

TABLE 3. COMPOSITION OF MATERIALS TO BE USED IN MIXTURES

	A	*B*	*C*	Mixture
SiO_2....	50.0	40.0	20.0	$50a + 40b + 20c$
Al_2O_3..	20.0	45.0	35.0	$20a + 45b + 35c$
CaO....	30.0	15.0	45.0	$30a + 15b + 45c$

By means of the expressions in the "mixture" column it is possible to determine the composition of any mixture of the three materials, if their proportions are known. For instance, if the fractional proportion of *A* is 0.27, the fractional proportion of *B* is 0.44, and the fractional proportion of *C* is 0.29, the composition of the mixture may be found by substituting these values for *a*, *b* and *c* in the expressions. In this case the per cent. of SiO_2 is $0.27 \times 50 + 0.44 \times 40 + 0.29 \times 20$, or 36.9%. Following this procedure for all of the expressions in the "mixture" column, the composition of the mixture is obtained.

Let us suppose now that it is desired to calculate the proportions of *A*, *B* and *C* to use to make a mixture which we will call *M*, having the composition 35% SiO_2, 30% Al_2O_3, and 35% CaO. The data required for the calculation are given in Table 4.

TABLE 4. DATA FOR COMPUTATION OF MIXTURE *M*

	Any mixture of *A*, *B* and *C*	Proposed mixture *M*
SiO_2..............	$50a + 40b + 20c$	35
Al_2O_3............	$20a + 45b + 35c$	30
CaO..............	$30a + 15b + 45c$	35

In any mixture of *A*, *B* and *C* the per cent. of SiO_2 is $50a + 40b + 20c$, as indicated in Tables 3 and 4. In the proposed mixture *M* the per cent. of SiO_2 is 35. These two values are consequently equal, and the following equation is obtained:

$$50a + 40b + 20c = 35$$

Similar treatment of the expressions for Al_2O_3 and CaO lead to the equations,

$$20a + 45b + 35c = 30$$
$$30a + 15b + 45c = 35$$

Since the sum of the fractional proportions of *A*, *B* and *C* is equal to 1.00, another equation may be set up:

$$a + b + c = 1$$

Since there are three values, *a*, *b* and *c*, to be determined, only three equations are required. Any three of the four equations may be used in the solution, obtaining: $a = 0.4167$, $b = 0.1250$, $c = 0.4583$. This result may be checked by substituting these values for *a*, *b* and *c* in the "mixture" column of Table 3, and it will be found that percentages of SiO_2, Al_2O_3 and CaO in the mixture correspond to the desired composition.

This method of computation may be used for any desired composition to be obtained from *A*, *B* and *C*. If the three materials are to be used for making a large number of mixtures, of different composition, it is rather tedious to set up equations for each

computation. In that case it is better to obtain a general solution by letting X, Y and Z represent the percentages of SiO_2, Al_2O_3 and CaO respectively in any desired composition. The equations then are

$$(25)\quad \begin{aligned} 50a + 40b + 20c &= X \\ 20a + 45b + 35c &= Y \\ 30a + 15b + 45c &= Z \end{aligned}$$

Solving for a, b and c, the following results are obtained:

$$(26)\quad \begin{aligned} a &= 0.02500X - 0.02500Y + 0.00833Z \\ b &= 0.00250X + 0.02750Y - 0.02250Z \\ c &= -0.01750X + 0.00750Y + 0.02417Z \end{aligned}$$

These may be written as follows:

$$(27)\quad \begin{aligned} a &= 0.02500\ SiO_2 - 0.02500\ Al_2O_3 + 0.00833\ CaO \\ b &= 0.00250\ SiO_2 + 0.02750\ Al_2O_3 - 0.02250\ CaO \\ c &= -0.01750\ SiO_2 + 0.00750\ Al_2O_3 + 0.02417\ CaO \end{aligned}$$

The fractional proportions of A, B and C to use in any mixture may be found by substituting the desired percentages of SiO_2, Al_2O_3 and CaO in the above equations. The similarity of the procedure to that used in deriving equations for calculating potential composition should be observed. This similarity is found also when the problem is treated by the graphic method. In Fig. 15 the materials A, B and C are located in the CaO-Al_2O_3-SiO_2 triangle. All mixtures of A and B are on the line AB, mixtures of B and C on BC, and mixtures of A and C on AC. All mixtures of A, B and C are in the triangle ABC. The mixture M, for instance, which has already been calculated, is inside the triangle. Compositions outside of the triangle cannot be made from A, B and C. It should be noted that within the triangle compositions may be described in two ways: (1) in terms of percentages of CaO, Al_2O_3 and SiO_2; (2) in terms of percentages of A, B and C. In the latter case materials A, B and C are regarded as components of the mixtures located within the triangle. The process may be described as a process of transformation of coordinates in which the vertices of the reference triangle are raw materials instead of oxides or compounds.

The regions outside of the triangle but inside of the broken lines are of special interest. The composition R (47.5% SiO_2, 30.0% Al_2O_3, 22.5% SiO) is typical of such compositions. In Table 5 the compositions of A, B, C and R are shown for comparison.

TABLE 5. COMPOSITIONS OF A, B, C AND R

	A	B	C	R
SiO_2	50.0	40.0	20.0	47.5
Al_2O_3	20.0	45.0	35.0	30.0
CaO	30.0	15.0	45.0	22.5

It will be observed that the percentage of SiO_2 in R is between the highest and lowest values for SiO_2 in the materials A, B and C. The same observation applies to the Al_2O_3 and CaO. By mere inspection it would seem that the composition R may be obtained by mixing A, B and C. The fact that R is outside of the triangle ABC indicates that this is impossible. If the composition of R is substituted in the equations in Series 27 it is found that c (the fractional proportion of C) has a negative value. Both the graphic method and the method of simultaneous equations have the advantage of indicating whether a given composition can or can not be made from a particular set of materials which it is proposed to use. If the equations indicate a negative value for the fractional proportion of any one of the materials it is known at once that the composition cannot be made.

When only three components are involved, and a large number of mixtures are to be made, useless computations can be avoided if the graphic method is used to determine whether or not desired compositions are possible. In Fig. 16, A, B, C, D, E and F represent materials available for making mixtures. All mixtures which can be made from these materials are included in the polygon $ABCDE$. Material F is inside of the polygon. It may be used in making mixtures in this region, but can be dispensed with if desired. Let us suppose that composition M is to be made from these materials, or from part of them. Since M is inside of the figure it is evident that it can be

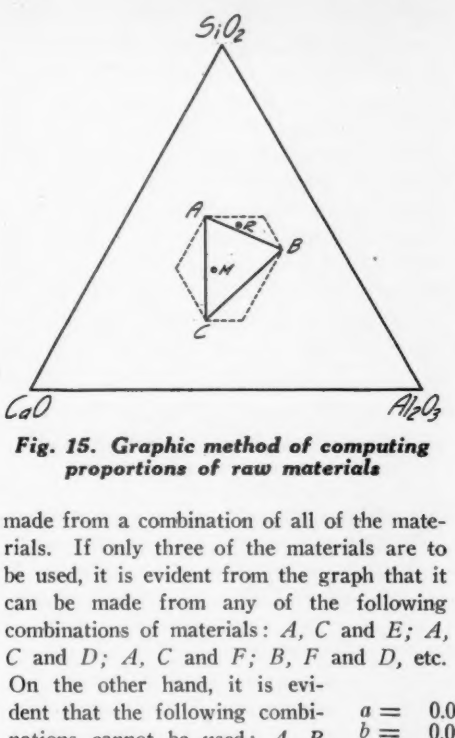


Fig. 15. Graphic method of computing proportions of raw materials

made from a combination of all of the materials. If only three of the materials are to be used, it is evident from the graph that it can be made from any of the following combinations of materials: A, C and E; A, C and D; A, C and F; B, F and D, etc. On the other hand, it is evident that the following combinations cannot be used: A, B and C; B, C and D; A, D and E, etc. Before starting any computations, a correct combination can be chosen, and considerable time saved.

In the computation of the proportions of A, B and C required to make the mixture M (Fig. 15), it was shown that there are three equations available from the data in Table 3, and another equation based upon the fact that the sum of the fractional proportions of materials in a mixture is equal to 1.00. Any three of the equations may be used in the solution of the problem. In the literal solution in Series 25, 26 and 27 the

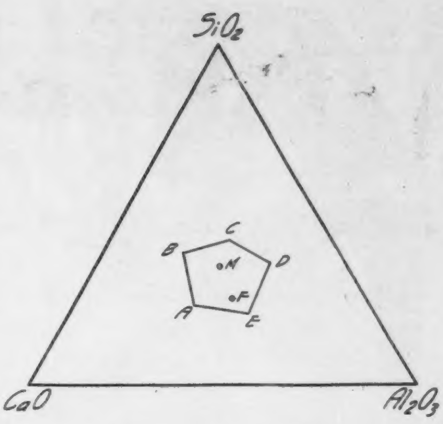


Fig. 16. Graph where five components are involved

equation $a + b + c = 1$ was not used. In the following solution of the same problem this equation is used instead of the third equation in Series 25. The equations are given below.

$$\begin{aligned} 50a + 40b + 20c &= X \\ 20a + 45b + 35c &= Y \\ a + b + c &= 1 \end{aligned}$$

Solving for a, b and c, the following results are obtained:

$$(29)\quad \begin{aligned} a &= 0.833 + 0.0167X - 0.0333Y \\ b &= -2.250 + 0.2500X + 0.0500Y \\ c &= 2.417 - 0.0417X - 0.0167Y \end{aligned}$$

If the percentages of SiO_2 and Al_2O_3 in a desired composition are substituted for X and Y respectively in these equations the fractional proportions of A, B and C will be obtained. These equations are more simple to use than the equations in Series 26 and 27, since only two substitutions are required in each equation instead of three. This advantage is generally obtained if an equation representing the fact that the sum of the fractional proportions of the materials is equal to 1.00 is chosen as one of the series of simultaneous equations to be solved.

The relation between the equations in Series 26 and those in Series 29 will now be considered. The sum of the percentages of SiO_2, Al_2O_3 and CaO in any mixture of the three components is 100, or

$$X + Y + Z = 100$$

Transposing,

$$Z = 100 - X - Y$$

Substituting this value of Z in Series 26, the following equations are obtained:

$$\begin{aligned} a &= 0.02500X - 0.02500Y + 0.00833\ (100 - X - Y) \\ b &= 0.00250X + 0.02750Y - 0.02250\ (100 - X - Y) \\ c &= -0.01750X + 0.00750Y + 0.02417\ (100 - X - Y) \end{aligned}$$

Upon simplifying these equations it is found that they are identical with the equations in Series 29.

(To be Continued)

Lime in Portland Cement

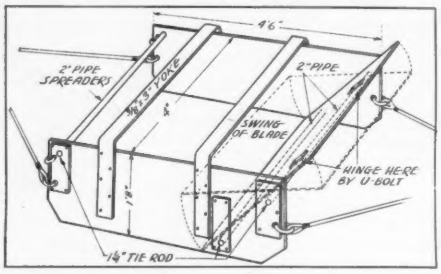
THE PRESENCE of up to 3% CaO has no effect on the uneven setting and mechanical strength of portland cement provided the mixture is uniform. Uniformity is attained by simultaneous grinding of the two substances.—*Chemical Abstracts.*

Hints and Helps for Superintendents

Drag Scraper Bucket with Swinging Blade

By Dare Paris
Monrovia, Calif.

OFTENTIMES around the rock products plant a small drag bucket can be used to great advantage for stock piling, feeding conveyor belts, etc. One of the accompany-



Cutting edge swings upward

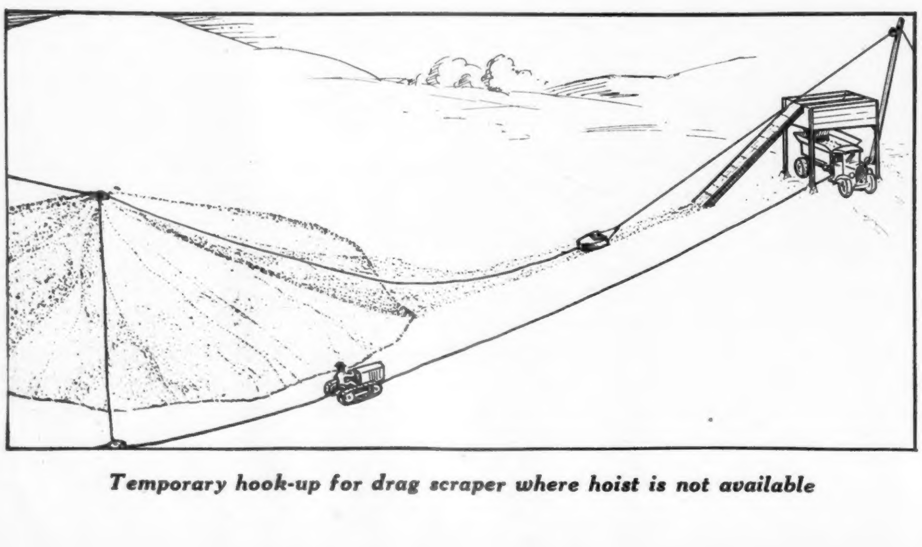
ing illustrations shows a drag scraper bucket which can be moved easily and at small cost.

The construction is simple and inexpensive, as the material is at hand around most plants, and it can be built in any shop. The body is built of ¼-in. steel plate and bolted together with 1¼-in. rods, using pieces of 2-in. pipe for spreaders. The digging blade is made of ⅜-in. steel and held in place by U-bolts fastened to the top spreader pipe. The bottom end is not fastened. This leaves the digging blade free to swing up when being pulled back through loose material.

The blade is adjustable for hard digging and for working in loose material. The adjustment for hard digging is made at the lower end of the blade by inserting iron shims between the blade and lower tie rod. For digging, the point of the blade should extend down ¼ in. below the sides of the bucket. For working in loose material, such as stock piling, the blade should be about even with the sides.

This type of bucket has proved satisfactory in working under water, as it causes a scouring action during the process of digging. When the empty bucket is pulled back through the water the force of the water pushing against the blade lifts it and this requires less power.

Where a temporary hook-up is needed but no hoist is available a tractor may be utilized. This system would not be practical for long hauls or continued operation, but may be found desirable in emergencies. This arrangement consists of two tail blocks, one head block and the required length of cable. Deadmen are used for holding tail blocks and a mast is used for carrying the head block. The load line is attached to the front of the tractor and tail line to the back, thus forming an endless line. The loading is done by running the tractor backward and forward. Loading from a stock pile to trucks is shown as one application. The bucket is pulled up an incline to the top of a small bunker holding about 6 cu. yd. Rails or sheet iron are used on the incline for the bucket to ride on. Rails are used on top of the bunkers to carry the bucket while dumping. The average tractor will handle a ⅓-cu. yd. bucket easily.



Temporary hook-up for drag scraper where hoist is not available

Movable Floodlight for the Plant Yard

WHERE PLANTS must be operated a considerable amount at night or where switching operations are carried on after dark it is necessary that adequate lighting be provided so that the men can work quickly and safely. The accompanying illustration shows a convenient portable floodlight that is in use at one Kentucky plant where much of the shipping is done at night.

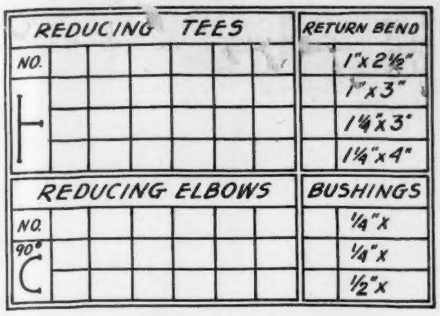
Floodlight is easily turned

A reflector and socket from an ordinary overhead electric fixture were used. These were attached to a short piece of iron pipe. Then the short piece was passed through a tee and wedged tight. Finally the tee was set up on a longer pipe which was driven into the ground. The connection was made to a socket in an overhead electric line by an ordinary cord. The light can be revolved completely around and will thus illuminate any portion of the yard. As it has no special base it is very easy to move.

A Kink for Checking Materials

By W. F. Schaphorst
Newark, N. J.

HERE is an ingenious and simple method for keeping a record of pipe fittings. This writer has never seen anything like it before.



Record sheet for pipe fittings

For example, where reducing tees have three different sizes of openings, as often happens, the problem of recording those openings in an orderly manner has heretofore always been a stickler. The accompanying illustration shows how easily it can be done.

Similarly, reducing elbows and return bends can be checked or recorded on the same blank. The blank therefore tells the whole story without the necessity of vexing explanatory remarks such as are to be found attached to the usual variety of records pertaining to fittings of this character.

Making Crusher Repair Easier

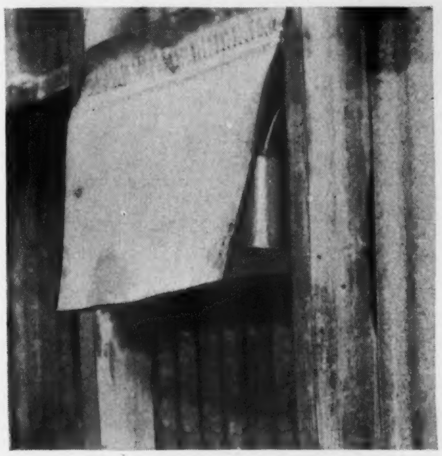
A JAW CRUSHER is used to crush oversize gravel at the plant of Graham Bros., Inc., in El Monte, Calif. A simple and cheaply installed movable chain block support has been installed to facilitate replacements and repairs. Parts for this support were all obtained from the scrap pile.

The wheels once served as car wheels. The main I-beam was part of an old truck frame, as were the shorter I-beam members that support the wheel bearings. The whole device is mounted on a wooden frame over the crusher so that crusher parts can be raised and carried out to a point where repairs can more readily be made.

Movable hoist facilitates crusher repair

A Use for Worn Belts

IN ALMOST every crushing plant old pieces of belt are used for coverings and protections for machinery, motors and other equipment. The accompanying illustration shows a portion of a discarded belt used to cover a shelf on which are kept greases and oils for use on the machinery.

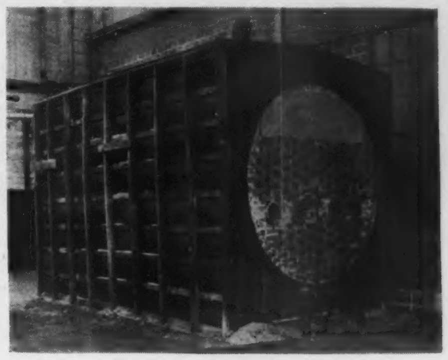


Keeps dust from oil and tools

The particularly interesting feature in this case is the use of the part of the belt adjacent to the lacing. The lacing is used as a hinge, so that the lower flap can be completely raised to give access to the whole shelf. With this hinge the flap falls tight against the shelf when not held up, so that complete covering is assured. Without the hinge the belt would tend to curl up after it has been bent up a few times and would give little protection.

Grinds Damp Material

IN THE Raymond Bros. Impact Pulverizer Co. dry-while-you-grind process, hot air up to 600 deg. F. is passed through a hammer mill so that extremely wet material can be pulverized and, at the same time, dried.



Supplies heat for drying mill

The fineness of the discharged product ranges from 40- to 300-mesh, depending on the type of material being ground.

The hot air is supplied from a furnace. The furnace can, if necessary or desirable, be furnished with the mill, but one southern California operator found it to his advantage to build his own furnace, using scrap material about the plant.

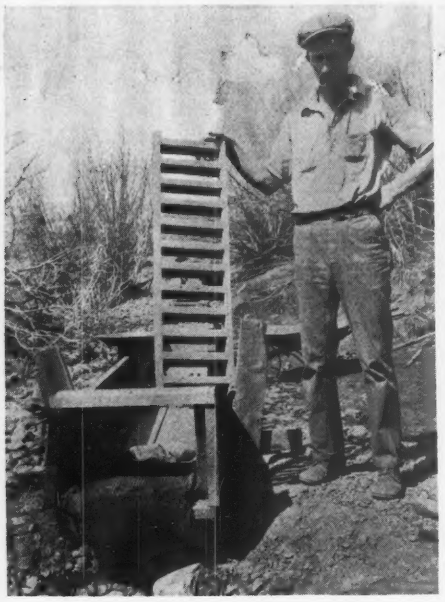
The illustration shows the exterior of the furnace made of steel plate suitably bolted together with tie rods. The furnace is lined with firebrick and the space between the steel walls and the brick is packed with diatomaceous earth. Natural gas is used for fuel. With few exceptions, all installations of this type of pulverizing mill on the Pacific Coast use oil for fuel.

Gold "Riffles"

AT VARIOUS TIMES Rock Products has published information on the possibilities of recovering gold from commercial sand and gravel deposits. Many operators think a test run could be accomplished only at considerable expense and annoyance. However, this is not the case, for a set of "riffles" can easily be installed under the primary screen from which the sand is first taken.

To do this find a place in your plant as close to the incoming sand as possible (not after the sand drags, for most of your gold might stay in the drag). The riffle, once installed, can be left in place all season without any attention. Of course, under such circumstances one need not expect to recover all the gold that passes through the plant, but at least one can get an idea as to the possibilities.

Riffles are simply obstructions in the bottom of the launder or flume, behind which any heavy gold can lodge. A favorite form of riffle in California is shown in the accompanying illustration. This type of riffle is held in place by wooden wedges. The cross



Gold riffles are easily made

slats are spaced on 3-in. centers and are made of 1x3 in. pieces. Each slat has a slope of 22 deg. and the set is installed with the slats pointing upstream.

If the flume or pan under the primary screen is rough or badly checked, place an old piece of carpet under the riffles when installing. Later the carpet can be burned and any fine gold collected.

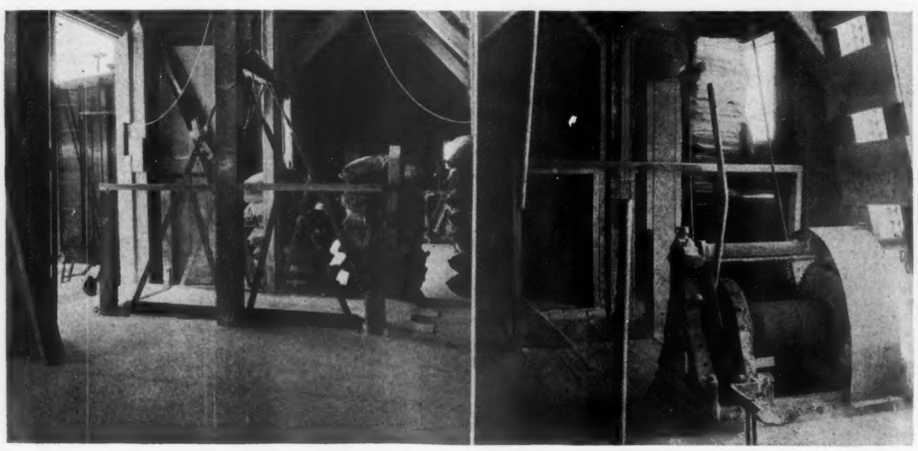
A carpenter or any handy man with tools can make and install a set of riffles in a day. Run your sand and water over the set for the season and then in the fall clean up your gold in a gold pan. You may be pleasantly surprised.

Home-Made Elevator

WHEN the Standard Gypsum Co. at Ludwig, Nev., built its first mill it was not considered necessary to have an elevator to elevate the relatively small amount of retarder and fiber used to the mixing floor.

Later, as business grew, Fred Bradfield, superintendent, located a single drum hoist and with this as a starting point assembled other material from which he built the elevator shown.

The elevator is so located that fiber and retarder from incoming cars can be quickly unloaded and stored on the mixing floor. The two illustrations show the main characteristics of the simple elevator.



Elevator costs little and saves much

Portable Compressor and Its Use

THE SAND and gravel pit of the Six Companies, Inc., is about seven miles from the plant, hence seven miles from a repair shop of any consequence. These operators know the value of compressed air for emergency use, hence have supplied the pit with a portable Ingersoll-Rand compressor

Finds many uses for it

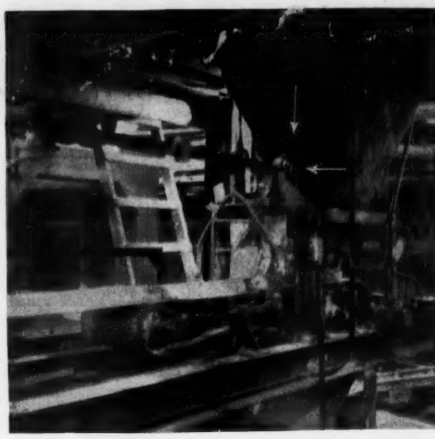
which is used for emergencies, repairs, and for supplying air for the 5-yd. electric Marion shovel, should its compressor fail.

The gravel is of such character that shooting or blasting is unnecessary, yet the foreman says this portable compressor is one of the handiest things on the job.

Bin Vibrator

AT THE PLANT of the Santa Cruz Portland Cement Co. at Davenport, Calif., calcined gypsum is added to the clinker instead of raw gypsum. The gypsum is calcined in a No. 50 Raymond Bros. Impact Pulverizer Co. "Imp" mill, which pulverizes, calcines, elevates and conveys the product all in one operation.

The calcined gypsum, or "stucco," is collected in suitable dust collectors and the material falls to steel bins below. The steel bins feed two Schaffer poidometers, one for each of two Hardinge mills used for clinker grinding.



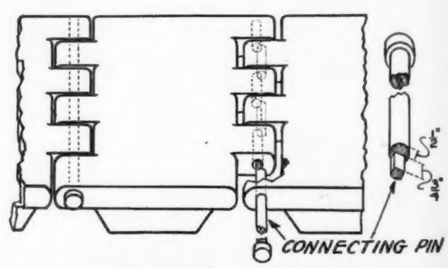
Increases uniformity of flow

To insure a steady and uniform flow of stucco to the poidometers, as the stucco tends to hang in the bin, the vibrating mechanism from an old electrically vibrated screen has been bolted to the outside of the feed bin.

If for any reason the flow of stucco to the poidometers ceases a small swinging arm that rides the material on the belt drops. This makes an electrical contact through a mercoid switch and starts the vibrator. The whole device is very successful.

Replacing Crawler Treads

WHEN replacing crawler treads difficulty is sometimes experienced in driving the last pin through the links, especially if the adjusting nuts have become frozen. Usually one side or end of the tread can be pulled

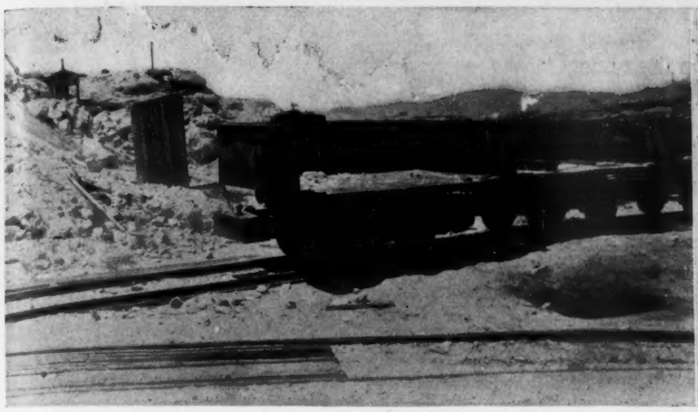


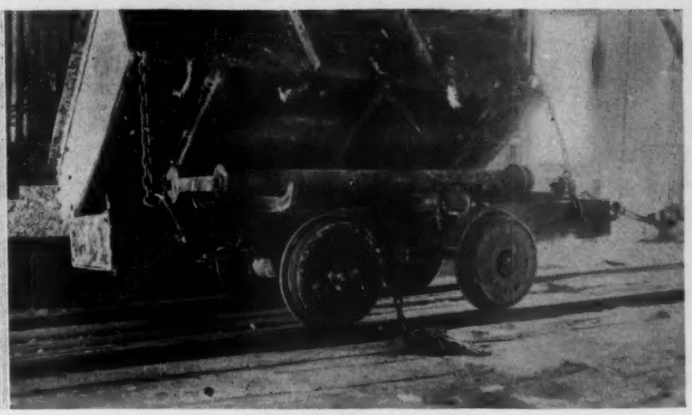
Pin draws treads together

together sufficiently by hand, or with a cable and the dipper, so that the first holes into which the pin should enter line up about one-half of a hole. If the pin is split on the end and one half cut away as illustrated it can be driven part way into the partially lined holes. By turning the pin 180 deg. the eccentric action will line up the next hole and the pin may be driven through. By repeating this action the treads may be brought together in a very short time.

Rock Cars for Hand Loading

SOME STATES, notably Missouri, are specifying that crushed stone for highway work be hand loaded. This is an unemployment relief measure. To meet this requirement, some operators will have to revamp their quarry haulage system, as the use of large capacity cars, owing to their





Low body dump cars are essential for hand loading in quarries

height, precludes the possibility of using them for hand loading. A low car body for hand loading is essential and the lower the better.

It is no simple matter to find a side-dump car having a capacity of 1 cu. yd. or more that is built close to the ground for easy hand loading, so the engineers of a western operation designed and built their own cars. These have been in use for 10 years or more and have been quite satisfactory.

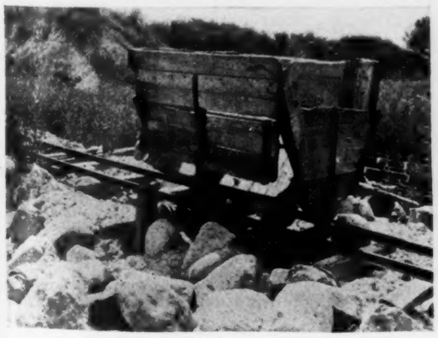
The dump mechanism is very simple and consists of two extra heavy 3-in. iron pipes with cast flanges at each end. These flanges make a groove that prevents longitudinal movement of the car body, as the light-weight steel rail that is bolted to the car body fits into the groove. Short chains prevent the body from leaving the truck while being dumped. The two illustrations show details of construction.

Getting Rid of Oversize from the Grizzly

THERE are many gravel plants equipped to handle only the smaller size stones from the pit, while the larger boulders are removed by a grizzly and discarded. It is often a problem to know how to get rid of these large rocks.

One company has laid a short, narrow-gage track from its grizzly to the edge of its pit, about 100 ft. away, and carries the stone back to the pit in a discarded, bottom-dump car. The loaded car can easily be pushed by hand, so the entire operation can be taken care of by the man in charge of feeding the material to the grizzly. Most of the rocks can be thrown from the grizzly into the car as easily as they could be tossed to a pile, and this method has the advantage of not requiring a second handling to get rid of them. They are effectively disposed of when dumped to the pit as that portion of the pit has been completely worked out.

The above idea might be improved by installing a sloping grizzly which would chute the oversize rock directly down into the dump car.



Quickly disposes of oversize

Inexpensive Sand Drag

CAPITAL investment has been kept low at one western sand and gravel plant. At the same time low operating costs have been obtained. The plant has a capacity of 85 tons per hr., employs five men, and makes average shipments of 20,000 cu. yd. per month.

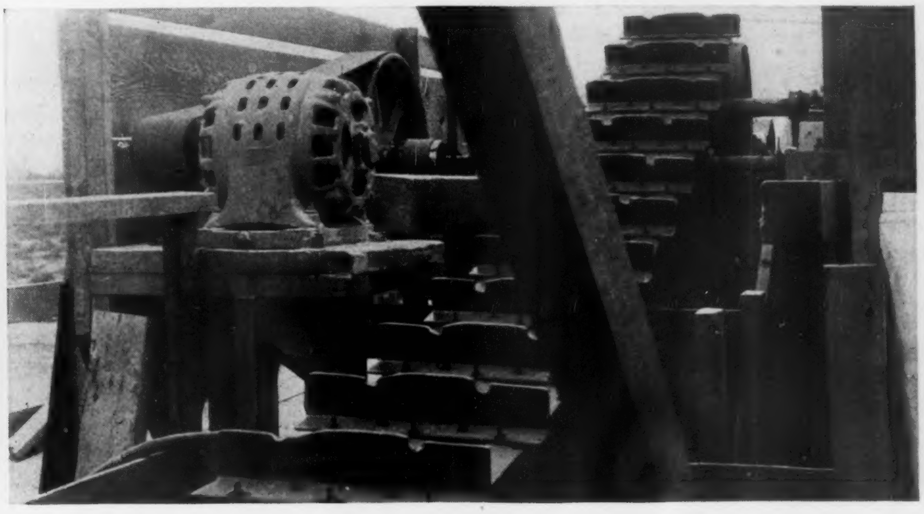
An interesting example of how investment has been kept low is shown in the construction of the sand drag, which was made entirely of what might be called waste material. The head pulley is a 24-in. cast iron pulley. The tail pulley is of pressed steel, 48 in. in diameter. An old piece of 16-in. conveyor belt was used on which to mount 4-in. angle iron flights that were saved from a scrap pile. These flights are spaced on 14-in. centers. The drag is driven by a 10-hp. Fairbanks-Morse motor.

The tail pulley runs immersed 22 in. in the sand. The sand tank is just wide enough to accommodate the drag belt. The length of the drag is 18 ft., center to center. The chief expenditure on the drag was the time spent in assembling it.

Keeping the Bucket Clear in a Drag Scraper Operation

AN ILLINOIS sand producer using a drag scraper in the pit was having trouble with the side of the cut, which would slide down and bury the bucket. The bucket was large and could not be extricated by pulling, so had to be dug out.

To prevent further trouble from the loose gravel on the side of the cut it was decided to keep all the loose material washed down. A hose was run from the plant pump and set in a tripod so that it was continually playing on the loose material at the side of the cut. The gravel was thus kept washed to the bottom of the cut, where it was at once picked up by the bucket and delivered to the plant. No further trouble has been experienced since this hose has been placed in operation.



Entire sand drag was made of "waste" material

General News Briefs

FEDERAL aid continues to be the subject of paramount interest to the rock products industry. The bill authorizing federal aid, which was approved by the Senate some time ago, seems to have become hopelessly lost in the House of Representatives. Keenly aware of the vital need of this measure, it was once more revived by the Senate. This was accomplished by amending legislation continuing the Federal Gas Tax passed by the House of Representatives so as to include the essential features of the highway authorization bill previously referred to the House. While hope has generally been abandoned by the present session of Congress even on legislation of paramount importance, hope has once more been revived as a result of the quick action on the long pending prohibition repeal measure, that other measures may enjoy similar last minute action.

The importance of action on the appropriation for Federal Aid roads has been keenly appreciated by those in the rock products industry, as Federal Aid funds have rapidly decreased until they have become practically depleted. This rapid depletion has increased the immediate volume of business for the industry, as indicated by awards for concrete roads, streets and alleys in January, 1933, which totalled 5,386,870 cu. yd., an increase of more than 100 per cent over the same month in 1932.

This large volume of awards undoubtedly is due to the desire to complete projects within the time limit specified for emergency work. At the same time a bill has been introduced to extend this period another six months, which should enable northern states to get those benefits from the legislation which it was intended to provide.

A number of states are planning large road programs for 1933. Among these are Kentucky, whose highway commission has announced the largest highway program for 1933 ever planned for the state in one year. About 1252 miles of new roads will be built. Florida's program calls for an expenditure of $3,500,000 for new road construction and $2,000,000 for maintenance. The California biennial budget for 1933-35 calls for $61,700,000.

It is also interesting to note that J. E. Pennebacker, managing director, Asphalt Institute, reports total asphalt sales for road work for 1932 approximately equal in tonnage to 1931.

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Gas Tax Diversion

Meanwhile the fight against gas tax diversion is constantly winning wider support. Highway Users Associations are being formed in many states, one of the latest being in Illinois. The National Automobile Dealers Association, and several motorists' associations are typical of organized groups now lending active support to the cause. The press has also given extensive help in waging "war" on diversion. In a warning note the Chicago (Ill.) *Daily News* says, "If the tendency to soak the motorists is not checked, legislators may discover some day that the highways are being used by a new type of automobile with astonishingly low consumption of gasoline and oil." "Economic recovery of the United States will be seriously retarded unless immediate halt is called to the indefensible practice of motor fund diversion," warns J. Burton Weeks, president, American Motorists' Association.

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Construction

Those who look to building for some indication of improvement in construction prospects no doubt found some satisfaction in the increase in volume for January over December. This was the result of further public works projects, though there is continued criticism of the rate at which available funds are being released for such work.

A bill to liberalize emergency construction provisions of emergency relief legislation has been passed by the Senate. This bill removes the "self-liquidating" requirement for loans by the R. F. C., and authorizes loans to states and municipalities for construction projects "if needful in the public interest." Officials of the R. F. C. declare there are many good projects upon which it can safely loan money, but that this has been prevented by legal restrictions.

Comparing present conditions to those during the war, Alfred E. Smith, former governor of New York, has urged appointment of a Director General of Public Works for the United States with power to cut through red tape and scrap hampering statutes to make the R. F. C. an effective weapon against the depression.

A meeting of state governors, called by President-elect Roosevelt, will consider federal aid for unemployment relief and mortgage foreclosures, among other things. It is believed likely that both direct and indirect relief will be included in the discussion.

Improvement of fundamental conditions is apparent. Demand for lower capital costs has reached effective size, and there are indications that interest rates will be reduced. In New York the Realty Stabilization Corp. has been formed by bankers and industrialists, whose plan "involves as an indispensable feature cooperation by mortgage holders in reducing interest charges on outstanding mortgages." Owen D. Young, W. C. Osborn and Mortimer N. Buckner are among those active in this organization. According to the *Wall St. Journal* (New York) this "will probably become the prototype of similar agencies throughout the country." In northern Ohio a similar organization, the Western Reserve Mortgage Co., is being formed. Lower interest rates on R. F. C. Loans have been urged in the Senate. The Hull bill, which provides for mortgage relief on farm lands, has been revised to include small urban homes as well. Credit given by Federal Home Loan Banks exceeds $75,000,000.

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Railroads

In past years railroads have been important consumers of rock products. Purchases in 1932, as with all other expenditures which might temporarily be stopped, were meager. Heralded as strongly indicative of improving conditions with railroads was the announcement that L. F. Loree, railway sage, had purchased a 10% interest in the New York Central railroad. This opinion may be further justified by the strength of rail securities. Another development looked upon as encouraging for the railroads was an agreement reached through the Rail and Highway Joint Committee. It is also believed that benefits may result from the report of the National Transportation Committee. As important purchasers of rock products, this industry should quickly benefit from a reestablishment of earning power by railroads. Road maintenance cannot be permanently abandoned if trains are to safely maintain schedules. These indications of coming improvement may provide justified cause for hope of renewed buying from this source.

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Muscle Shoals Development

President - elect Roosevelt's seven - point plan for development of the Tennessee river water shed has aroused wide interest and comment. The project is based largely on putting to use the present Muscle Shoals development. No large construction projects are outlined in the project, but undoubtedly such a development would stimulate demand for construction materials throughout the area.

A proposal has been made by the Co-op Trust, Inc., recently incorporated, to utilize 75% of the output of power in the manufacture of cement, which would be turned over to the government in payment for the concession. By-products obtained in the manufacturing process are expected to pay operating and overhead expenses, pus a profit.

Editorial Comment

Power Costs

There is a rising tide of protest against charges for electrical energy in the rock products industry—particularly among crushed stone and gravel producers. While unit labor costs have been much reduced by more efficient and economical management, no recourse is possible, apparently, to reduce relatively higher unit power costs. In very many instances power rates are held at levels prevailing in 1928-29 and the effect on the operator is enhanced by cutting down of operating time. During 1932, for example, if a plant operated only a few days a month the power bill alone in some instances cited to the editor actually exceeded the sales price of the products produced!

The price of electrical energy furnished by power companies is usually based on three factors; always on the first two of these: (1) a maximum demand factor; (2) an energy factor; (3) a power factor.

If a plant requires 1000 kw., even for only a few minutes at a time, the power company must have facilities for making and delivering to the plant 1000 kw. This equipment must be amortized over a reasonable period and this is the justification for the maximum demand charge. When a plant is operated only two or three days a month this demand factor becomes the largest factor in the bill.

The energy factor represents the power actually consumed in operating the plant. Under normal operating conditions it is of course the main item in power costs.

The power factor is a measure of the surplus generating and transmitting equipment required to furnish energy, and in the interests of efficiency many power companies penalize the purchaser for a poor power factor. There are various ways of improving power factor at small expense, and the power companies are always glad to assist in reducing this element of power cost.

The problems to be met by the rock products operator are: (1) Can the power companies be induced or compelled to lower their rates, and how? (2) In what other ways can power costs be brought into line with other costs?

In some instances the power companies have voluntarily reduced their rates to industrial users. The chief motive in the cases known to the editor seems to have been the genuine fear that the operator would install his own power plant. With the low cost of fuel oil and the high efficiency of the Diesel engine this fear on the part of the companies is well founded. As mentioned in the Annual Review Issue of Rock Products, December 31, 1932, several operators have installed such power-generating units recently and others are contemplating doing so.

There is no argument so strong as that based on self-interest, and the prospective loss of business to the power companies will undoubtedly bring about a lower electric power rate quicker than an appeal to public utility commissions or any other method of approach. With builders of Diesel engines and electric power generating equipment as keen for business as everyone else, it will cost operators little or nothing to get estimates on such power plants. Better still might they employ a competent consulting electrical engineer to go over their power problems in detail and report on methods of reducing power costs.

For there are other ways of reducing power costs, even with present rates. One sand and gravel operator at the recent convention of the National Sand and Gravel Association, gave a clue when he described how his company had reduced its maximum demand charge by operating its dredging equipment and its processing plant, alternately, instead of simultaneously. In other words, if the demand for the product required but 6 days' operation a month, instead of operating the entire plant 6 days and shutting down the rest of the month entirely, the dredge was operated 6 days and shut down, the raw material being stocked near the screening and washing plant. Then the screening and washing plant was started and operated 6 days to process the material.

Presumably this cut the demand charge for power about in half, as well as making it possible to use the same crew throughout, giving, say, 6 or 7 men 12 days' work, instead of 12 or 14 men 6 days' work. Obviously this scheme is in the interests of economy, if not in line with the "spread-the-work" idea. However, by using a different crew for the next operating period, the work also could be distributed among more men.

Another way to reduce power costs and increase efficiency would be for a group of producers to pool their orders and allow the most efficient plant of the group to get out all this material by continuous operation. The competitive element could be retained and the various producing organizations kept intact by rotating the producing of material—that is, allowing each of the plant organizations one or two or three months' continuous operation to see which could make the best material the cheapest.

It is obvious that these are extraordinary times, and extraordinary measures must be taken to meet them. Co-operative selling organizations have not thus far been very successful due to the usual jealousies and misunderstandings. The problems of the day must be met cooperatively, if they are met at all. The same applies to solving the problem of high power costs. It can be assumed that the power companies need the business and can be persuaded or compelled to make any *necessary* and justifiable concession to retain it, unless it is more profitable for them to lose than to retain this business. On the other hand, the power companies have a cost-of-production basis for price structure which other industries might well imitate. Whether they are getting exorbitant prices for their product in view of present costs, is not within our province to discuss. But power company costs and financial structures are usually available and can be inquired into and used in all arguments over rates.

Recent Quotations on Rock Products Securities

Stock	Date	Bid	Asked	*Dividend
Allentown P. C. 1st 6's[27]	2-21-33	No market		
Alpha P. C. com.	2-21-33	5¾	6¼	25c qu. Apr. 25
Alpha P. C. pfd.	1-14-33	50	85	1.75 qu. Dec. 15
Amalgamated Phos. 6's, '36[19]	12-24-32	92	95	
American Aggregates com.[19]	12-24-32	1	4	
American Aggregates pfd.[19]	12-24-32	15	25	1.75 qu. Jan. 1
American Aggregates 6's w.w.[19]	12-24-32	32	....	
American Aggregates 6's ex-w.[19]	12-24-32	30	....	
Amer. L. & S. 1st 7's[27]	2-21-33	40	....	
Arundel Corp. com.	2-18-33	12½	13½	50c qu. Jan. 3, '33
Bessemer L. & C. Class A[4]	2-16-33	1	3	
Bessemer L. & C. 1st 6½'s[4]	2-16-33	18¼	17½ actual sale	
Bessemer L. & C. cert. of dep.[4]	2-16-33	13	14¼ actual sale	
Bloomington Limestone 6's[27]	2-21-33	No market		
Boston S. & G. new com.[37]	2-16-33	2	4	5c qu. July 1
Boston S. & G. new 7% pfd.[37]	2-16-33	10	20	1.75 qu. Jan. 3, '33
Boston S. & G. 7's, 1934[10]	2-16-33	50	60	
California Art Tile, A	1-13-33	½	....	
California Art Tile, B[9]	12-22-32	....	4	
Calaveras Cement com.	2-17-33	1	5	
Calaveras Cement 7% pfd.	2-15-33	....	70	1.75 qu. Jan.15,'33
Canada Cement com.	2-18-33	3⅛	3⅛	
Canada Cement pfd.	2-18-33	20¼	20	1.62½ qu. June 30
Canada Cement 5½'s	2-18-33	69	72	
Canada Crushed Stone bonds[42]	2-16-33	70½	....	
Canada Crushed Stone com.[42]	2-16-33	1	No market	
Certainteed Products com.	1-14-33	1	1⅛	
Certainteed Products pfd.	1-16-33	5	7	1.75 qu. Jan. 1
Certainteed Products 5½'s	1-16-33	39 actual sale		
Cleveland Quarries	2-18-33	....	16	10c qu. Dec. 1
Consol. Cement 1st 6½'s, A[44]	21-21-33	3	5 (nominal)	
Consol. Cement pfd.[27]	2-21-33	No market		
Consolidated Oka Sand and Gravel (Canada), 6½'s[12]	2-16-33	40	....	
Consolidated Oka Sand and Gravel (Canada) pfd.[42]	12-27-32	....	50	
Consol. Rock Prod. com.[35]	2-15-33	....	15c	
Consol. Rock Prod. pfd.[35]	2-15-33	....	75c	
Consol. Rock Products units[35]	12-22-32	¾	1¼	
Consol. S. & G. pfd. (Can.)	1-16-33	....	50	50c qu. Nov. 15
Construction Mat. com.	1-16-33	⅛	1	
Construction Mat. pfd.	1-16-33	1⅛	4½	
Consumers Rock and Gravel, 1st Mtg. 6's. 1948[35]	12-22-32	18	22	
Coosa P. C. 1st 6's[27]	1-18-33	10	....	
Coplay Cem. Mfg. pfd.[47]	2-21-33	5	7	
Coplay Cem. Mfg. 6's, 1941[47]	2-21-33	55	60	
Dewey P. C. com.[47]	2-21-33	50	60	
Dolese and Shepard	2-21-33	9½	11	$1 qu. Jan. 1
Dufferin Pav. & Cr. Stone pfd.	2-18-33	10	10	1.75 qu. Apr. 1
Dufferin Pav. & Cr. Stone com.	2-18-33	1	....	
Edison P. C. com.[47]	2-21-33	1	3	
Edison P. C. pfd.[47]	2-21-33	3	5	
Federal P. C. 6½'s, 1941[47]	2-21-33	55	60	
Giant P. C. com.[47]	2-21-33	1	3	
Giant P. C. pfd.[47]	2-21-33	4	6	
Gyp. Lime & Alabastine, Ltd.	2-18-33	1½	2	
Gyp. Lime & Alabastine 5½'s	2-18-33	....	37	
Hermitage Cement com.[47]	2-21-33	5	10	
Hermitage Cement pfd.[47]	2-21-33	20	25	
Ideal Cement 5's, 1943[47]	2-21-33	80	85	
Ideal Cement com.	1-16-33	12	15	25c qu. Jan. 2, '33
Indiana Limestone 6's[27]	2-21-33	No market		
International Cem. com.	2-21-33	7¼	8	50c qu. Mar. 31
International Cem. bonds, 5's	1-16-33	60¼ actual sale		Semi-ann. int.
Kelley Island L. & T.	2-18-33	8½	9½	25c qu. Jan. 2, '33
Ky. Cons. Stone com.[45]	2-16-33	No market		
Ky. Cons. Stone 7% pfd.[45]	2-16-33	No market		
Ky. Cons. Stone 1st Mtg. 6½'s[45]	2-16-33	8	10 (nominal)	
Ky. Cons. St. V. T. C.[45]	2-16-33	No market		
Ky. Rock Asphalt com.	2-18-33	¾	1¼	
Ky. Rock Asphalt pfd.	2-18-33	8½	12	
Ky. Rock Asphalt 6½'s, '38	2-18-33	53	55	
Lawrence P. C.	2-20-33	5½	7½	
Lawrence P. C. 5½'s, 1942[47]	2-21-33	42	46	
Lehigh P. C. com.	2-21-33	5⅞	6½	
Lehigh P. C. pfd.	2-17-33	36½	40	87½c qu. Jan.3,'33
Louisville Cement[47]	2-21-33	45	55	
Lyman-Richey 1st 6's, 1935[18]	2-15-33	85	95 (nominal)	
Marbelite Corp. com. (cement products)	1-13-33	5c	50c	
Marbelite Corp. pfd.	1-13-33	25c	....	
Marquette Cement com.[47]	2-21-33	7	8	
Marquette Cement pfd.[47]	2-21-33	45	50	1.50 qu. Jan.3,'33
Marquette Cem. Mfg. 1st 5's, 1936[46]	2-21-33	60	65	
Marquette Cem. Mfg. 1st 6's, 1936[46]	2-21-33	60	65	
Material Service Corp.	1-10-33	5	7½	
McCrady-Rodgers 7% pfd.[22]	2-15-33	20	25	87½c qu. June 30
McCrady-Rodgers com.[22]	2-15-33	No market		75c qu. Jan. 26
Medusa P. C. pfd.[47]	2-21-33	30	35	1.50 qu. Apr. 1
Medusa P. C. com.[47]	2-18-33	4	6	
Monarch Cement com.[47]	2-21-33	35	45	
Michigan L. & C. com[6]	12-24-32	52	....	
Missouri P. C.	2-20-33	4¾	6	25c qu. Jan. 30
Monolith Portland Midwest[9]	2-15-33	....	50c	
Monolith P. C. com.[9]	2-17-33	1	1½	40c s.-a. Jan. 1
Monolith P. C. pfd.	2-17-33	1¾	2⅜	40c s.-a. Jan. 1
Monolith P. C. units[9]	12-22-32	3½	4¼	
Monolith P. C. 1st Mtg. 6's[9]	12-22-32	35	40	
National Cem. (Can.) 1st 7's[27]	2-21-33	70	80 (nominal)	
National Gypsum A com.[27]	1-18-33	1¾	2¾	
National Gypsum pfd.[27]	1-18-33	25	....	1.75 qu. Jan. 2, '33
National Gypsum 6's[3]	2-21-33	68	72	
National L. & S. 6½'s, 1941[19]	12-24-32	65	75	
Nazareth Cement com.[47]	2-21-33	2	4	
Nazareth Cement pfd.[47]	2-21-33	18	21	
Newaygo P. C. 1st 6½'s[47]	2-21-33	38	42	
New England Lime 6's, 1935[14]	2-16-33	10 (nominal)		
N. Y. Trap Rock 1st 6's	1-16-33	53½ actual sale		
N. Y. Trap Rock 7% pfd.[27]	2-21-33	....	50	1.75 qu. Jan. 3, '33
North Amer. Cem. 1st 6½'s	1-16-33	18 actual sale		
North Amer. Cem. com.[27]	2-21-33	No market		
North Amer. Cem. 7% pfd.[27]	2-21-33	½	....	
North Shore Mat. 1st 6's[15]	2-21-33	23 (nominal)		
Northwestern States P. C.[47]	2-21-33	25	28	
Ohio River S. & G. com.	2-18-33	....	5	
Ohio River S. & G. 1st pfd.	2-18-33	....	50	
Ohio River S. & G. 2d pfd.	2-18-33	....	20	
Ohio River S. & G. 6's[10]	12-24-32	40	50	
Oregon P. C. com.[9]	12-22-32	8	12	
Oregon P. C. pfd.[9]	12-22-32	80	85	
Pacific Coast Aggr. com.[40]	12-22-32	....	½	
Pacific Coast Aggr. pfd.[40]	12-23-32	....	1	
Pacific Coast Aggr. 6½'s, 1944[5]	12-23-32	10	11	
Pacific Coast Aggr. 7's, 1939[5]	12-23-32	3	5	
Pacific Coast Cement 6's[5]	12-23-32	41	....	
Pacific P. C. com.[9]	2-15-33	3	....	
Pacific P. C. pfd.	2-17-33	30 actual sale		1.62½ qu. Jan.5,'33
Pacific P. C. 6's, 1935	12-22-32	83	....	
Pacific P. C. 6's, 1936	12-22-32	83	....	
Peerless Cement com.[47]	2-21-33	10c	20c	
Peerless Cement pfd.[47]	2-21-33	4	6	
Penn.-Dixie Cement com.	2-21-33	⅞	1	
Penn.-Dixie Cement pfd.	2-21-33	5	7	
Penn.-Dixie Cement 6's	1-14-33	44 actual sale		
Penn. Glass Sand Corp. pfd.[27]	1-18-33	35	45	1.75 qu. Apr. 1
Penn. Glass Sand Corp. 6's[19]	12- 2-32	75	80	
Petoskey P. C.	2-20-33	1¼	1¾	
Port Stockton Cem. com.[9]	12-22-32	No market		
Riverside Cement, A[9]	2-15-33	4	6	
Riverside Cement, B[9]	12-22-32	....	1	
Riverside Cement pfd.	2-15-33	57½	60	1.50 qu. Feb. 1, '33
Sandusky Cement 6's[19]	12-24-32	75	85	
Sandusky Cement 6½'s, 1932-37[27]	2-21-33	65	75	
Santa Cruz P. C. com.	2-15-33	65	....	$1 qu. Jan. 1, '33
Schumacher Wallboard com.	2-15-33	1	....	
Schumacher Wallboard pfd.	1-13-33	3	....	50c qu. May 15
Signal Mt. P. C. pfd.[47]	2-21-33	3	5	
Southwestern P. C. units[47]	2-21-33	110	120	
Southwestern P. C. com.[47]	2-21-33	15	20	$1 qu. Jan. 1, '33
Southwestern P. C. pfd.[47]	2-21-33	55	60	$2 qu. Jan. 1, '33
Standard Paving & Mat. (Canada) com.	1-16-33	....	1½	
Standard Paving & Mat. pfd.	1-16-33	....	25	50c qu. Nov. 15
Superior P. C., A	2-15-33	....	26¼	27½c mo. Mar.1,'33
Superior P. C., B	2-15-33	5	8¼	12½c Dec. 20
Trinity P. C. units[47]	2-21-33	10	15	
Trinity P. C. com.[47]	2-21-33	1	3	
Trinity P. C. pfd.[47]	2-21-33	8	12	
U. S. Gypsum com.	2-21-33	20½	21¼	40c qu. Jan. 2, '33
U. S. Gypsum pfd.	2-21-33	105¼	110	1.75 qu. Jan. 2, '33
Wabash P. C.[47]	2-21-33	4	7	
Warner Co. com.[27]	1-18-33	2	3	
Warner Co. 1st 7% pfd.[27]	1-18-33	13	18	1.75 qu. Apr. 1
Warner Co. 6's, 1944, w. w.	12-22-32	30 actual sale		
Whitehall Cem. Mfg. com.[47]	2-21-33	9	12	
Whitehall Cem. Mfg. pfd.[47]	2-21-33	20	25	
Wiscon. L. & C. 1st 6's, '33[15]	2-21-33	25 (nominal)		
Wiscon. L. & C. 6½'s[10]	12-24-32	25	35	
Wolverine P. C. com.	2-21-33	½	1	
Yosemite P. C., A com.[9]	2-15-33	1⅕	....	

*Latest 1932 dividend unless otherwise stated.

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers. Tracy Co., Chicago. [4]Butler, Wick & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Company, Chicago, Ill. [16]G. M. P. Murphy & Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co., Ltd., Toronto, Canada. [42]Nesbitt, Thompson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill. [48]Hemphill, Noyes and Co., New York City.

Financial News in Brief

Consolidated Rock Products Co., Los Angeles, Calif., will pay semi-annual interest and sinking fund due January 2, 1933, on bonds of its subsidiary, Consumers Rock and Gravel Co.

Net loss of $589,458 for 1932 is reported by Consolidated Rock Products, compared with loss of $24,518 in 1931. Cash at end of year totaled $245,274 and current assets aggregated $561,639 against current liabilities of $324,806.

✦ ✦ ✦

Consolidated Oka Sand and Gravel Co., Ltd., Toronto, Ont., trustee has advised holders of 6½% bonds that "foreclosure proceedings at the present time would be ill-advised." A report on the company states: "In common with practically all industries, the company is showing the effects of the existing depression; the quality of washed river sand produced is excellent; the company is under competent direction and is a basically sound business."

✦ ✦ ✦

Giant Portland Cement Co., Philadelphia, Penn., reports as follows on its operation during 1932:

EARNINGS, CALENDAR YEAR

Calendar years—	1932	1931
Net loss after depreciation and taxes	*$225,088	*$164,797
Deduct—		
Loss on dismantling of machinery, etc.	886	3,306
Net loss	$225,974	$168,103

*After depreciation of $107,055 in 1932 and $107,264 in 1931.

BALANCE SHEET DECEMBER 31

ASSETS

	1932	1931
Real estate, buildings, machinery, etc.	$2,449,362	$2,552,806
Cash	161,988	212,171
Chicago Board of Education notes	19,975	59,925
Notes and accounts receivable	51,174	15,682
Demand notes	50,000	100,000
Sundry debtors	2,284	1,879
Rents and interest receivable	4,425	9,615
Inventories	368,437	375,340
Deferred charges	4,427	8,153
Total	$3,112,073	$3,335,571

LIABILITIES

	1932	1931
Preferred stock	$1,627,400	$1,627,400
Common stock	1,103,753	1,103,981
Accounts payable	12,816	10,806
Customers' credit balances	729	715
Payroll and unclaimed wages	1,348	1,203
Accredited interest and taxes	*1,185	652
Reserve for contingencies, etc.	9,000	9,000
Surplus	355,839	581,813
Total	$3,112.073	$3,335,571

*Accrued taxes only.

✦ ✦ ✦

Standard Paving and Materials, Ltd., Toronto, Ont., has advised Toronto Stock Exchange that directors of the company have ratified the by-law providing for retirement of 971 preferred shares, which have been turned over to transfer agents for cancellation. Preferred stock now outstanding totals 13,105 shares.

Consumers Material Corp., Kansas City, Mo., is defendant in foreclosure suit planned to permit reorganization of the corporation to take it out of the hands of receivers.

✦ ✦ ✦

Consumers Co., Chicago, Ill., and subsidiaries report net loss of $931,892.00 for year ended December 31, 1932, after interest, depreciation, depletion, taxes, etc., and after providing $221,847 for write-down of accounts receivable, comparing with net loss of $442,700 in 1931.

Current assets as of December 31, last, amounted to $5,897,504 and current liabilities were $2,779,764.

✦ ✦ ✦

Marblehead Lime Co., Chicago, Ill., reports on operations for 1932 as follows:

INCOME ACCOUNT

(Year ended November 30)

	1932	1931
Net sales	$ 511,400	$ 713,279
Cost of sales	402,027	552,779
Selling, administration and general expenses	99,689	116,397
Depreciation	63,817	69,870
Depletion	1,753	2,962
Operating profit	(d)55,886	(d)28,729
Other income (net)	4,311	6,931
Total income	(d)51,575	(d)21,798
Bond interest	30,468	32,219
Bond discount and expense	4,406	5,111
Net income	(d)$86,448	(d)$59,128
Earned per share, common	(d)$7.82	(d)$5.87
Number of common shares,	14,000	

BALANCE SHEET

ASSETS:	1932	1931
*Quarry lands	$ 440,491	$1,524,579
†Buildings, kilns, etc.	819,888	
Plant real estate	200,503	
Current assets:		
Cash	32,817	56,601
Receivables	35,405	36,346
Inventories	100,910	115,658
Cash value, life insurance	33,211	29,091
Due on stock subscription	....	18,900
Investments	7,497	7.717
Other assets	23,736	3,667
Deferred charges	30,984	38,360
Total	$1,725,443	$1,830,919

LIABILITIES

	1932	1931
Preferred A stock	$343.000	$11,500
Preferred B stock		331,500
‡Common	768,514	768,514
First 6s due 1933-39	475,000	533,000
Current liabilities:		
First 6s due	30,000	....
Accounts payable	74,576	69,906
Accrued interest, taxes, etc.	34,014	29,711
Surplus	340	86,788
Total	$1,725,443	$1,830,919
Current assets	$ 202,345	$ 237,696
Current liabilities	138,589	99,617
Working capital	$ 63,756	$ 138,079

*After depletion (1932, $48,943). †After depreciation (1932, $509,428). ‡Represented by 14,000 no par shares.

✦ ✦ ✦

North American Cement Corp., New York City, has notified the New York Stock Exchange that it will default the interest due March 1 on 6½% sinking fund gold debentures, series A, due 1940 (with warrants). Exchange has ruled until further notice debentures shall be dealt in "flat." Committee headed by L. M. Blanche announces debenture holders depositing on or before February 15 may withdraw from any proposed plan without charges.

A bond holders protective committee has been formed consisting of Leo M. Blancke, chairman, A. W. Loasby and W. E. Stanley. George K. Graves, Jr., is secretary with office at 15 Broad St., New York, N. Y.

✦ ✦ ✦

Lawrence Portland Cement Co., Northampton, Penn., reports loss from operations for 1932, before depreciation, interest and other charges, of $55,608.37. Loss, after all charges, is reported as $672,497.99. The balance sheet, as of December 31, 1932, follows:

ASSETS

Current assets:		
Cash		$ 162,330.15
Notes and accounts receivable:		
Trade	$127,203.94	
Less: Reserve	29,102.74	
		98,101.20
Inventories—valued at lower of cost or market:		
Finished stock and work in process	$302,633.54	
Raw materials, supplies and repair parts	412,384.66	
		715,018.20
Mutual insurance deposit		33,676.39
Sundry debtors		4,680.83
Total current assets		$1,013,806.77
Investments—at book value		223,300.00
Fixed assets—at book value:		
Land, buildings, machinery and equipment	$11,563,376.42	
Less: Reserve for depreciation	3,103,809.77	
		8,459,566.65
Deferred charges:		
Unamortized quarry development costs	$99,529.80	
Unamortized bond discount	54,944.50	
Prepaid insurance, etc.	2,118.90	
		156,593.20
		$9,853,266.62

LIABILITIES

Current liabilities:		
Accounts payable and accrued charges		$ 54,709.83
Note payable, due November 18, 1933		60,000.00
Total current liabilities		$ 114,709.83
15-yr. 5½% gold debentures, due April 1, 1942:		
Originally issued	$2,000,000.00	
Retired through sinking fund	450,000.00	
	$1,550,000.00	
Less: Held in treasury	46,000.00	
		1,504,000.00
Capital and surplus:		
Capital stock — Issued and outstanding 75,000 shares of $100 par value	$7,500,000.00	
Surplus	734,556.79	
		8,234,556.79
		$9,853,266.62

✦ ✦ ✦

Iron City Sand and Gravel Co., Pittsburgh, Penn., has a bond holders' protective committee formed for its first mortgage bonds. The committee is reported to be working on a plan of reorganization.

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Consolidated Sand and Gravel, Ltd., Toronto, Ont., has deferred dividends on 7% cumulative preferred stock due February 15.

American Lime and Stone Co., Bellefonte, Penn., reports for [illegible] years ending December 31:

INCOME ACCOUNT

	1932	1931
Net sales	$611,739	$976,090
Operating expenses, etc.	564,470	805,355
Depreciation and depletion	91,932	120,084
Operating income	(d)44,663	50,651
Other income	24,597	36,104
Total income	(d)20,086	86,755
Interest	75,876	81,181
Surplus	(d)95,962	5,574
Times interest earned	0.27	1.07

BALANCE SHEET

Assets:	1932	1931
*Land, buildings, machinery, etc.	$2,010,128	$2,077,026
Current assets:		
Inventories (net)	94,991	111,926
Receivables and securities (net)	102,660	185,850
Cash	37,092	28,434
Sinking fund cash, etc.	32,813	34,726
Compensation insurance fund	25,251	23,981
Deferred charges	83,811	95,802
Total	$2,386,746	$2,557,745
Liabilities:		
6% pfd. stock (par $100)	$700,000	$700,000
Common stock (par $50)	500,000	500,000
Bonded debt	944,000	988,000
Current liabilities:		
Accounts payable, etc.	18,111	20,965
Sundry reserves	27,719	24,235
Surplus and undivided profits	196,915	324,545
Total	$2,386,746	$2,557,745
Current assets	$234,743	$326,210
Current liabilities	18,111	20,965
Working capital	216,632	305,245

*After depreciation: 1932, $956,268; 1931, $922,539.

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Material Service Corp., Chicago, Ill., announces its annual meeting has been postponed until March 20 pending completion of company's audit.

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Pennsylvania-Dixie Cement Corp., New York, N. Y., and subsidiary companies, report operating income for 1932, before depreciation, depletion, and interest, as $106,176.83, but after these charges the loss was $1,866,230.92.

In his letter to stockholders, Blaine S. Smith, president, says: "Our bin cost of sales, during operations, was less than in 1931, notwithstanding a 37% reduction in production, and was lower than that of any previous year. Our production and shipments were less than one-third capacity. . . . Selling prices advanced, but most of the year's business was at the lowest levels in more than 15 years. Our average price realized in 1932 was 9 c. per bbl. less than in 1931, and 70 c. less than in 1926. . . . The subnormal construction of the last two years has doubtless created a large accumulated need in certain fields for new structures and the rehabilitation and modernization of old ones which will evidence itself in increased cement demand when confidence is restored and general business conditions become more normal."

CONSOLIDATED BALANCE SHEET
ASSETS
(As of December 31, 1932)

Current assets:			
Cash	$ 2,910,286.40		
Notes and accounts receivable:			
Customers, less reserves		328,696.88	
Others		13,129.76	
Inventories at cost or market, whichever is lower:			
Cement, process stocks, bags, etc.		$ 1,252,994.02	
Machinery parts and supplies		519,853.21	
		$ 1,772,847.23	$ 5,024,960.27
Fixed assets:			
At reproduction cost, less depreciation, as appraised as of June 30, 1926, plus subsequent additions at cost:			
Land, mineral reserves, buildings, machinery, equipment. etc.		$35,371,039.92	
Less—Reserves for depletion and depreciation		13,412,926.85	
			21,958,113.07
Investments, etc., less reserves			93,639.01
Deferred charges to future operations			22,128.84
			$27,098,841.19

LIABILITIES

Current liabilities:		
Accounts payable	$ 78,961.91	
Accrued wages, interest, taxes, etc.	241,335.35	
Reserve for federal income taxes	....	
		$320,297.26
Reserves:		
Miscellaneous operating reserves	$ 71,971.34	
Reserve for contingencies	35,725.84	
		107,697.18
First mortgage sinking fund 6% gold bonds, Series A, due September 15, 1941:		
Issued	$14,515,000.00	
Redeemed and cancelled	2,607,000.00	
	$11,908,000.00	
Less — Held in treasury	2,253,000.00	
		9,655,000.00
Capital stock and surplus:		
7% cumulative preferred stock	$12,500,000.00	
Common stock of no par value	4,000,000.00	
	$16,500,000.00	
Surplus	515,846.75	
		17,015,846.75
		$27,098,841.19

PROFIT AND LOSS AND SURPLUS

Net sales		$3,476,723.77
Manufacturing cost of sales		3,370,546.94
Operating profit before depreciation and depletion		$106,176.83
Provision for depreciation and depletion		1,382,402.02
Loss from operations		$1,276,225.19
Interest charges	$590,005.73	590,005.73
Net loss for the year		$1,866,230.92
Surplus balance January 1, 1932	$1,551,306.62	
Profit on purchase of corporation bonds	267,148.69	
Excess of par value over cost of preferred stock retired	563,622.36	
		2,382,077.67
Surplus December 31, 1932		$515,846.75

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Northwestern Portland Cement Co., Seattle, Wash., reports operating profit for 1932 of $88,302.29 compared with $38,256.16 in 1931.

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United States Gypsum Co., Chicago, Ill., reports net income of $1,599,416 after depreciation and taxes for the year ended December 31, 1932, equivalent after allowance for preferred dividends to 86 c. a share on 1,218,349 shares of $20 per value common stock.

In his annual report to stockholders, S. L. Avery, president, stated:

"Building activities continue at a low level. Production costs and overhead expenses have been subjected to continual reductions in an effort to meet conditions.

"The building of new mills and the decline in business have reduced the value of some of the older plants. Based on the tonnage allotted to such plants, the board of directors at the May meeting authorized a reduction in plant account of $7,700,000 to meet this condition. The balance sheet gives effect to this revision as of January 1, 1932."

CONSOLIDATED INCOME ACCOUNT
(Years ended December 31)

	1932	1931
Operating profit	$3,160,225	$5,789,927
Other income, net	437,101	373,517
Total income	3,597,326	6,163,444
Depreciation and depletion	1,786,583	2,256,403
Federal taxes	61,327	343,899
Special provision for bad debts	150,000	....
Net income	1,599,416	3,563,143
Previous surplus	28,675,751	28,235,563
Adjustment of Canadian exchange	21,509	*116,619
Total surplus	30,296,676	31,682,087
Reduction value plant	7,700,000	....
Losses on plants, patents, inventories	503,845	551,451
Preferred dividends	547,552	548,753
Common dividends	1,903,828	1,906,131
P. & L. surplus	19,641,451	28,675,751

*Deduction.

CONSOLIDATED BALANCE SHEET
(As of December 31)
ASSETS

Current assets:	1932	1931
Cash	$ 1,556,623.07	$ 923,034.18
Government securities	10,605,416.44	9,180,467.46
Municipal bonds	1,250,289.06	1,064,917.79
Accounts and notes receivable	2,848,377.90	3,490,465.33
Construction contracts receivable	178,396.33	229,265.80
Inventories	2,796,015.62	3,736,901.06
Total	$19,235,118.42	$18,625,051.62
Stock purchase contracts	$ 1,532,697.93	$ 1,657,749.61
Bonds and other securities	343,266.65	266,838.57
Total	$ 1,875,964.58	$ 1,924,588.18
Plant and equipment	50,053,018.49	61,178,091.47
Deferred charges	994,354.43	1,071,295.68
Total assets	$72,158,455.92	$82,799,026.95

LIABILITIES

	1932	1931
Current liabilities:		
Accounts payable	$ 255,910.58	$ 577,491.68
Dividends payable	612,834.90	....
Accrued liabilities	270,164.68	598,794.92
Total liabilities	$ 1,138,910.16	$ 1,176,286.60
Reserves (including deprec. and dep.)	$13,590,742.16	$14,267,349.96
Net worth:		
Preferred stock	$ 7,822,200.00	$ 7,822,200.00
Common stock outstanding	24,366,980.00	24,349,440.00
Common stock subscribed	....	....
Surplus	25,239,623.60	35,183,750.39
Total	$57,428,803.60	$67,355,390.39
Total liabilities and net worth	$72,158,455.92	$82,799,026.95
Net working capital	$18,096,208.26	$17,448,765.02

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Recent Dividends Announced

Lehigh Portland Cement pfd. (qu.)	$0.87½	April 1
Boston Sand and Gravel Co. pfd. (qu.)	1.75	Jan. 3
Mathieson Alkali Works, Com. (qu.)	0.37½	April 1
Mathieson Alkali Works, Pfd. (qu.)	1.75	April 1

Rock Products News Briefs

Cement

NO MATTER what direction prices take, the cement industry has learned that changing prices are favorite targets for politicians. When prices dropped complaints were made of discrimination—a drop of price on one contract brought demands for reductions on previous contracts. Now, with prices advancing, proposals for state-owned plants again make their appearance. Such suggestions have been proposed in both Indiana and Colorado. New administrations wish to win public applause. Economic considerations are pushed aside. Michigan, whose state-owned cement plant has been a political football for years and which was officially abandoned last year, once more comes to the fore through a resolution calling for legislative investigation as to the desirability of abandoning it. In Missouri a legislative investigation is being carried out on past awards of cement contracts and of recent bids on state contracts.

Meanwhile from South Dakota, whose state-owned plant has been held out as an example of properly conducted state enterprise, the *Sioux Falls Argus-Leader* raises questions about the actual cost of the state-owned cement plant, answers to which are given on the balance sheet of privately owned business, and without which information no true knowledge of actual profit or loss from operation can be reached. For politicians or citizens interested in facts a careful review of the earnings statements of a number of the well managed privately owned cement companies during past years should afford positive answer to the desirability or economic advantage of state-owned plants, and whether present prices for cement are profitable. These same people might profitably study the recent report of a committee of the house of representatives which strongly condemns government competition with private business and urges the ending of such competition.

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WHILE oil and cement normally do not mix at all well, the Ideal Cement Co. seems to have found a happy combination through its subsidiary, the Boetcher Oil and Gas Co. The latest well to be proved was on February 1, when a 3000 bbl. well was brought in near Holdenville, Okla. The well is also reported to produce 25,000,000 cu. ft. of gas.

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THE *Charles City* (Ia.) *Press* insists that someone is accumulating property near Floyd with the intent of building a cement plant. This was first attributed to the Lehigh Portland Cement Co., whose officials promptly and emphatically denied any interest. According to the *Press*, options have been secured on about 800 acres of land, including a site for a hydro-electric plant. It is claimed both cement and "plaster" will be manufactured.

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UNIVERSAL Atlas Cement Co., Chicago, Ill., recently purchased 7½ acres of industrial property from the Material Service Co. located on the Calumet river at Ewing Ave. The property is some distance from the Buffington plant, but is connected by the Elgin, Joliet and Eastern railroad, another U. S. Steel subsidiary company.

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TARIFF revision is awaited with much interest by the cement industry. As yet there is little definite information on what may be anticipated. There are a number of major problems to be handled by the new administration and tariff is one of them. Reductions will be most strenuously opposed. What the final outcome will be is still anybody's guess.

Gypsum

THE United States Gypsum Co., Chicago, Ill., has started construction of a $100,000 wallboard plant at Midland, Calif., from which it will supply future Pacific coast board requirements. Officials of the company state there is no foundation for the report, recently published in the *Wall St. Journal* (New York)., that "progress has been made toward perfecting a by-product fertilizer having a gypsum base . . . making it a more balanced fertilizer to include phosphates and nitrogenous compounds."

◆ ◆ ◆

PETITION of the Standard Gypsum Co., Seattle, Wash., asking the same rates for intrastate shipments as shipments from point of origin of raw material, was denied, it being held that present railroad rates are "just and reasonable."

Lime

A FEW manufacturers of agricultural lime concentrated on such sales at the 17th annual Pennsylvania Farm Show, held recently. Exhibitors included the American Lime and Stone Co., the Whiterock Quarries, Inc., Universal Gypsum and Lime Co. and H. E. Millard.

◆ ◆ ◆

A NEW lime plant, capitalized at $200,000, is now under construction by the James River Hydrate and Supply Co. near Buchanan, Va. The company was organized and the plant is being built to manufacture a finishing lime from dolomite. L. P. Dillon of Indian Rock is president of the new organization, F. C. Dillon is secretary-treasurer and J. H. McNamara is vice-president. Crushed stone and fluxing stone will also be sold. Capacity for finishing lime will be 30 tons per day.

Phosphate

IN THE Tennessee district the proposal of President-elect Roosevelt to develop that region has been of particular interest to producers of rock phosphate. Tremendous quantities of fertilizer should be required as that plan is carried out, and local mining districts naturally should participate in such development. It is doubtful that there is any connection between this announcement and a report that owners of a large independent phosphate deposit at Columbia will start immediate construction on a new plant for the manufacture of a finished product; or that the Hoover and Mason Phosphate Co. is making extensive alterations and improvements to its plant there, but at least it indicates increasing confidence in the future.

◆ ◆ ◆

FROM another field comes the request for investigation of imports of phosphate and superphosphate into this country, and a Senate resolution has approved such investigation by the United States Tariff Commission. Imports from Europe, Japan and Canada, and the arrival of a shipload of apatite from Russia have started what promises to be a thorough investigation.

Rock Asphalt

NEW MEXICO has recently begun experiments on rock asphalt as a surfacing material for major highways. Large deposits of this product have been discovered in New Mexico and attempts made to commercialize them during the past few years.

Sand and Gravel

IN NEW JERSEY a proposal to eliminate gravel as an aggregate for concrete roads was abandoned by the State Highway Commission after a hearing at which protests were lodged by representatives of the New Jersey Constructors' Association. The revised specification sanctions the use of gravel, trap rock, and dolomite, but with a reservation that trap rock may be used in place of gravel on particular jobs.

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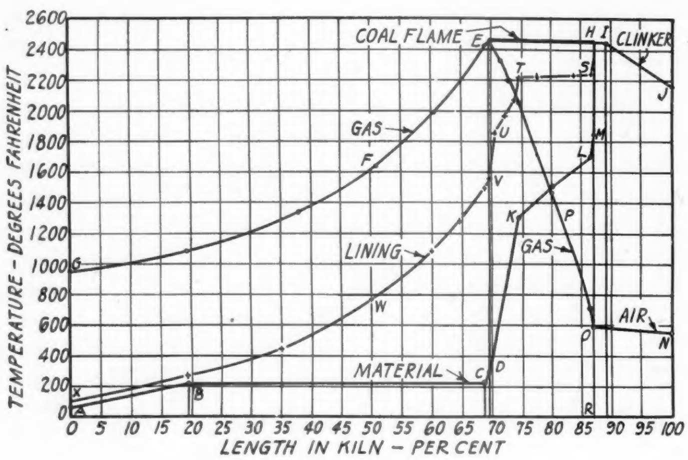
LABELING his bill a measure to "take the sand and gravel industry out of politics," Assemblyman A. L. Moffat of New York has introduced a bill in the legislature that would authorize removal and sale of sand and gravel from Lake Erie and other state lands under water under state regulation and supervision. The proposal calls for a payment to the state of 3 c. per cu. yd. for all such material removed from state lands. It is estimated that this would produce an annual income of $500,000.

Digest of Foreign Literature

By F. O. Anderegg, Ph.D.
Consulting Specialist, Pittsburgh, Penn.

Heat Transmission in Rotary Kilns. W. Gilbert has accumulated sufficient data to warrant a detailed analysis of the manner in which heat is imparted to material as it travels through the kiln. By trial and error, formulas have been worked out and checked against observations so that the effect of kiln dimensions on coal consumption can be safely predicted. Working with a 44.6% slurry in a kiln 202 ft. long, with enlarged burning zone, about 40 ft. were required to raise the slurry to 212 deg. F. and about 100 ft. for evaporation of moisture. During the next 11.8 ft. the temperature was raised to 1300 deg. and from there the temperature rose to 1700 deg. during decarbonation in 23.4 ft. During the next 1.1 ft. clinkering started with a rise to 1850 deg. During the next 4 ft. the temperature jumped to 2450 deg. "by the heat liberated when clinker is made," i. e., the reaction is now exothermic and equivalent to 1.35 lb. (17,000 B.t.u.) of standard coal per 100 lb. clinker. Then comes cooling for 22 ft.



Heat transmission in rotary kiln

The temperatures of the gas, lining and material are shown in the accompanying chart. The combustion is complete at *E* with maximum gas temperature, while the rapid rise in the material during clinkering is important. It is estimated that the material gets its heat in several ways: 37.3% by radiation from the gases, H_2O, N_2 and CO_2; 12.0% by convection, from the lining and from direct contact; and 50.7% by radiation from the incandescent coal particles. As the diameter increases, less of the heat is transmitted by convection, but more by radiation. The average temperature of clinkering is set at 2450 deg. It may go higher, which usually means ring formation. This temperature seems to be partly independent of the amount of excess air.

Suppose a kiln could be designed so efficient that the gases would leave at 212 deg. F., we would have the following heat balance:

	Per cent of clinker
Decomposition of $CaCO_3$	7.16
Raising temp. to 212 deg. and evaporating moisture	8.92
Waste gas loss at 212 deg.	1.47
Kiln and cooler radiation and net clinker loss	3.05
	20.60
Less exothermic reaction	1.35
	19.25

This is equivalent to 70.5 lbs. standard coal per barrel of cement. The first three quantities are fundamental in the manufacture of portland cement by the wet process and cannot be reduced. *Cement and Cement Manufacture* (1932) **5**, pp. 417-425. (To be continued.)

Exothermic Reaction in Formation of Clinker from Clay, Slag and Limestone. Dr. Elsner reports his experiments at a meeting at the Kaiser Wilhelm Institute for Silicate Investigation on determining the heats of formation of clinker. If a mixture of clay and limestone is heated in an electric furnace having a constant temperature rise of about 4 deg. C. per min., with thermocouples in the raw mix and in the furnace, the first lag of the former comes between 400 and 500 deg. as the clay loses its water of composition. At 900 deg. decarbonation causes another break, while at 1300 ± 100 deg., according to the nature of the raw materials, a clinkering takes place which is exothermic. The usual method of determining the exothermic heat of this reaction has been to determine the heats of solution of the raw material heated to about 910 deg. and of the clinker. This does not take account, however, of any changes in specific heat taking place during the reaction, for which a suitable correction must be made. A series of mixtures of slag and limestone were burned in a Lepol kiln. The difference in the heats of solution was about 60 cal. per gram. On correcting for differences in the specific heats, this value must be reduced by 6 cal.—*Tonindustrie Zeitung* (1932) **56**, No. 102, p. 1254.

Quantitative Analysis of Free Lime in Lime-Alumina Compounds with Help of X-Rays. W. Buessem gives a discussion of the possibilities of this method at the Kaiser Wilhelm Institute for Silicate Investigation meeting. Since the intensity of the lines determined by the Debye-Scherrer method is proportional to the amount of corresponding crystal present, in certain cases fairly accurate estimates may be had of crystalline substances, such as free lime, by working with a weighed amount of material.—*Tonindustrie Zeitung* (1932) **56**, No. 100, p. 1229.

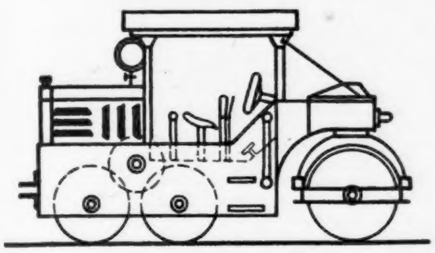
Constitution of Hydrates of Calcium Aluminates and Their Double Salts. L. Forsen of Sweden also presented a paper on this subject using the well known Werner coordination method to explain the formation of the various hydrates of the calcium aluminates, their double salts, including especially, the sulfo- and chloroaluminates, which are formed in the presence of gypsum or calcium chloride. Tricalcium silicate is regarded as a salt of the hypothetical H_6SiO_5 and on hydration and hydrolysis goes in steps to Hillebrandite $Ca_2H_2SiO_5$, Afwillite $Ca_3H_6(SiO_5)_2$ and Plombierite CaH_4SiO_5.—*Tonindustrie Zeitung* (1932) **56**, No. 100, pp. 1228-1229.

Hardening and Corrosion of Cement. When mixtures of portland and aluminous cements are placed on a microscopic slide with excess water crystals of "dicalcium aluminate" form due to interaction of lime from the portland cement with alumina from the other cement. Cements, however, made up with amounts of water used in practice showed very little crystal formation, except for a few calcium hydroxide crystals in portland cement, so far as could be determined with the microscope. This confirms the Mischaelis theory of gel hardening.—*Cement and Cement Manufacture* (1932), **5**, pp. 426-433.

Sieve Limitations and the Fineness Modulus. By A. Hummel. The grading of aggregates for concrete might follow either some ideal curve such as the Fuller or similar curve, or a specification of maximum and minimum amounts passing various screens, or the fineness modulus. The Germans have felt the influence of the Fuller curve and have from time to time suggested refinements. However, results on gap grading obtained by Friesecke in Germany, and by

Early, Furnas and Anderegg in the U. S. A., show that many gradings outside the usual continuous grading specifications give satisfactory strength, density and workability, so that care might well be exercised in establishing sieving limits. Therefore, the fineness modulus may have a more general usefulness in drawing up specifications for concrete aggregates.—*Zement* (1932) **21,** No. 48, pp. 671-675: No. 49, pp. 687-691.

New Power Roller. Tony Ballof proposes to follow the front steering wheel with two smaller rollers in tandem and fastened rigidly to a frame so that on passing over a road, a truly plane surface is left. In this way an improved riding surface is obtained.—*Pierres & Minerals* (1932) **4,** pp. 640-641.



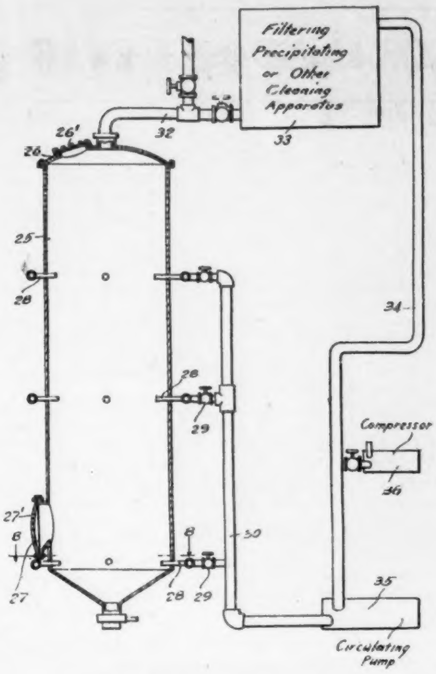
New power roller

Deterioration of Building Stones. Dr. Alois Kieslinger of the Technical University of Vienna has written a book containing results of numerous observations of decomposition on natural stone buildings in Austria. The similarity of disintegration of stones in places having frost and in those where frost is absent shows that frost as such is not the chief cause. Moisture working in and out builds up a crust or "patina" at the surface of the stone. Viewed superficially this might seem to be desirable, but in the course of time, perhaps ten years, the crust begins to split off due to the growth of crystals accumulated in the pores immediately behind. Protective coatings, such as oil paints have often a similar action. Many other topics are discussed. The title is "Zerstörungen an Steinbauten" and may be obtained from Baumarkt, Berlin-Steglitz, Fichtestr. 58.

Patent Abstracts

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Mixing Dry, Raw Cement Materials. The method is that of blowing air through jets into the mass of unmixed materials in a closed vessel. The air which escapes passes through an air filter or precipitator which collects any dust escaping with the air. Two forms are described, one for low and one for high pressures. The use of high pressure air has the advantage of putting the materials in a "fluid" condition (as they are in a pneumatic cement pump) and the high pressure form is illustrated.

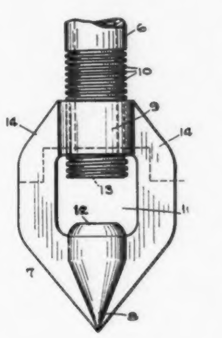


Mixes with compressed air

The large closed tank holds the material and the air is admitted through the nozzles entering the side of the tank. After passing the filter, precipitator or other cleaning apparatus, the air goes back to the compressor.

The specifications describe a model 6 ft. high, and experiments made with it to show the thoroughness with which it mixed the raw materials. It had a 2-ft. depth of limestone, CO_2, 40.7%, and 4 ft. of clays running from 0.23% to 6.34% of CO_2. After 1½ hr. mixing the CO_2 contents at every foot except the lowest (which would not be drawn off in practice) were: 19.6%, 19.8%, 19.2%, 19.2%, 19.9%.—*Evald Anderson, Assignor to Western Precipitation Co, Los Angeles, Calif. U. S. Patent No.* 1,839,456.

Testing Gravel Deposits. This method of testing employs a pipe with a head as shown. This has two flat sides, or fins, to keep it from rotating when the pipe is turned. By screwing down on the pipe until it hits the piece (12) below, whatever is collected in the pipe as it is driven into the deposit is held there. The pipe is in joints which may be coupled in the ordinary way, the lower pipe being so held that it cannot turn. Joints about 6 ft. long are recommended.—*Virgil M. Haddon. U. S. Patent No.* 1,845,709.

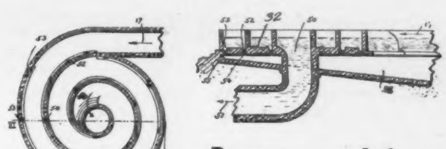


Traps sample

Making White Cement from Colored Clays. Clays from which white cement can be made are scarce. The inventor says that white cement can be made from clays containing from 2 to 5% of metallic oxides by removing the oxides in insoluble compounds according to his methods. He adds a mixture of 4 parts fluorspar and 1 part sodium phosphate which has been burned and ground, or the same mixture with the substitution of ½ part of borax for ½ the sodium phosphate. The effect, he says, is to form colorless glass of the metallic oxides at a temperature below that of clinkering. Further heating does not change these glass compounds, which do no harm in the final product.

A modification is to add the same substances and burn in a reducing atmosphere. This converts the metallic oxides to metals which may be removed by known methods, such as magnetic separation.—*G. Bergen et al., Assignors to "Miag" Muhlenbau und Industrie Aktiengesellschaft, Brunswick, Germany. U. S. Patent No.* 1,865,418.

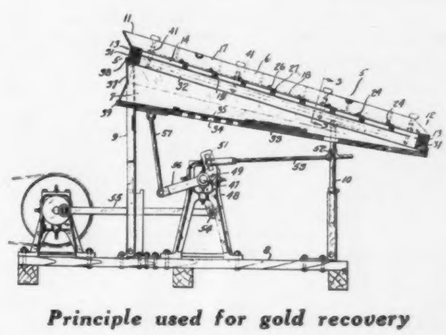
Centrifugal Sand Separator. This separator is in two forms, and that chosen is the form the inventor says is adapted to recover sand and gravel from a flowing stream, such as the discharge of a dredge pump. The stream rises in the center pipe (50) and flows out into a volute or scroll. Centrifugal



Recovers sand from flowing stream

action throws the sand against the side and it falls down through the narrow passages into the space (56) below. Enough water will accompany the sand to wash it out. The other form of this invention is really a series of such volutes so designed that finer materials may be recovered. The inventor says that it will remove the finest silt from water. —*F. W. Kerns et al. U S. Patent No.* 1,880,185.

Dry Washer. This device is a mechanization of the dry washer used in the arid regions of the United States for recovering placer gold. There is a collapsible compartment which serves as a bellows. On top of this is a canvas top with riffles. As this is moved up and down puffs of air rise through the canvas and stratify the material and the riffles send the heavy particles one way and the light particles the other.—*H. S. Bennett et al. U. S. Patent No.* 1,848,151.



Principle used for gold recovery

TRAFFIC and TRANSPORTATION

Proposed Rate Changes

THE FOLLOWING are the latest proposed changes in freight rates up to the week ending February 18:

New England

28172. **Stone, crushed** (See Note 3), from Branford (Pine Orchard Quarry), East Haven, East Wallingford (Reeds Gap Quarry), Meriden (York Hill Quarry), Mt. Carmel, New Britain (Cook's Quarry), Rocky Hill, Conn., and Westfield (Hampden Quarry), Mass., to Quinebaug, Conn., Rates per net ton:

Representative Changes

From	Prop.	Pres.
Branford (Pine Orchard Quarry), Conn.	$0.90	$1.30
Westfield, Mass.	1.00	1.30

28192. **Limestone, fluxing, dolomite, broken, crushed or ground,** from Ashley Falls, Great Barrington, Lee, Pittsfield, Sheffield, West Stockbridge, Mass., Canaan, Danbury, East Canaan, New Milford and Redding, Conn., to Hailesboro, Emeryville, Hyatt, Lakeville and Edwards, N. Y. Representative—From Ashley Falls, Mass., to Edwards, N. Y., proposed, 18c; present, 23c.

Trunk Line

30227. **Sand, other than glass,** in open top cars, carloads (See Note 2), changes origin point to read Freeman, Penn., in lieu of Hutchins, Penn.

30440. **Crushed stone,** carloads (See Note 2), from White Haven, Penn., to Mauch Chunk, Penn., 40c per net ton, to expire April 30, 1933, and effective May 1, 1933, rate of 44c per net ton, to expire July 31, 1933. On and after August 1, 1933, rate of 70c per net ton will apply.

30446. **Sand,** carloads (See Note 2), from Newport, N. J., to Ottawa, Ont., 26½c; Sherbrooke, Que., 24c, and Beauharnois, Que., 26c per 100 lb.

30372. To cancel rate of $4.28 per net ton on **molding sand,** from Albany district sand producing points, Saratoga Springs and Gansevoort, N. Y., to Rivere a Pierre, Que. Classification basis to apply.

30399. **Limestone, unburned, ground,** carloads, minimum weight 50,000 lb., from Natural Bridge, N. Y., to Addison, Canisteo, Castile, Goshen and Belmont, N. Y., 16c per 100 lb.

30406. **Stone, broken or crushed, coated with oil, tar or asphalt.** The oil, tar or asphalt not to exceed 10%, by weight, of the commodity, carloads (See Note 2), from Oriskany Falls, N. Y., to Wilkes-Barre, Penn., $1.80 per net ton (plus 6c net ton emergency rate to expire April 30, 1933).

30543. To increase rate of $2.50 to $2.75 per net ton on **slag,** carload (See Note 2), from Perth Amboy, Maurer and Carteret, N. J., to Clicquot and Mills, Mass.

30456. **Stone, crushed,** carload (See Note 2), from Snow Flake, W. Va., to Two Mile, W. Va., $1.30; Etowah to Cornwell, W. Va., $1.40; Porters to Clay, W. Va., and Dundon, W. Va., $1.50, and Spread to Villa Nova, W. Va., $1.60 per net ton.

30492. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carload (See Note 2), from Marlboro, N. Y., to Narrowsburg, Skinner's Falls, Cochecton, Callicoon, Hankins and Long Eddy, N. Y., $1.40 per net ton.

Central

34661. To establish on **stone, raw or crude, crushed, ground or pulverized** (unburned), in box car equipment, carloads, minimum weight 60,000 lb., to Powhatan, O., from Genoa and Martin, O., rate of 180c per net ton.

34662. To establish on **crushed stone, crushed stone screenings** and **agricultural limestone** (not ground or pulverized), in bulk, in open top cars, carloads, from Kokomo, Ind., to Peru, 60c; Denver, 65c; Macy, 70c; Rochester, Tiosa, 75c; Plymouth, Ind., 85c per net ton, plus emergency charge. (Decrease.)

34705. To establish on **sand** (except blast, core, engine, filter, fire or furnace foundry glass, grinding or polishing, loam, molding or silica) and **gravel,** carloads, from Fairview and Swanville, Penn., to Mann, Wick, 100c; Hartford, O., 110c per net ton, plus emergency charge. (Increase.)

34711. To establish on **crushed stone** and **crushed slag,** in open top cars, carload, from Buffalo, N. Y., to Colza, Spring Creek, 100c; Althom, Cobham, 110c; Tidioute, W. Hickory and Oil City, Penn., 120c per net ton, plus emergency charge. (Reduction.)

34722. To amend Item 1670 of C. F. A. L. Tariff 130-U, publishing 60% of sixth class rating on **limestone, crushed, ground or pulverized,** carload, minimum weight 60,000 lb., from points in Illinois, including East Bank Mississippi River crossings to points in C. F. A. and Trunk Line arbitrary territories by providing for the addition thereto of LaSalle, Ill., as a point of origin. Present, classification basis.

4733. To establish on **slag,** carloads, from West Middlesex, Penn., to Albion and Cranesville, Penn., rate of 80c per net ton. Present, 90c.

34419. To establish on **crushed stone,** also **agricultural limestone,** in bulk, in open top cars, carloads, actual weight will apply, from Keeport, Ind., to Benton Harbor, 122c; Sodus, Eau Claire, Berrien Springs, 117c; Niles, Mich., 112c per net ton. (Increase.)

34422. To establish on **crushed stone** and **crushed stone screenings,** carloads, from Narlo, O., to West Oberlin, O., rate of 80c per net ton, plus emergency charge.

34426. To establish on **crushed stone,** carloads, from Putnamville, Ind., to Dana, Ind., rate of 88c per net ton.

Note 1—Minimum weight marked capacity of car.
Note 2—Minimum weight 90% of marked capacity of car.
Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

34506. To establish on **sand and gravel,** carloads, from Dundee, O., to Philo, O., rate of 95c per net ton, plus emergency charge. (Reduction.)

34507. To establish on **crushed stone,** in open top cars, carloads, to Leipsic, O., from Carey and McVittys, O., rate of 100c per net ton, plus emergency charge. (Increase.)

34508. To establish on **crushed stone,** in open top cars, carloads, actual weight will apply, from Carey and McVittys, O., to Ashtabula, 110c; Conneaut, 120c; Jefferson, O., 135c per net ton, plus emergency charge. (Increase.)

34553. To establish on **crushed stone,** carloads, in open top equipment, from Carey, O., to Plymouth, Greenwich and New London, O., rate of 54c per net ton, plus emergency charge. (Reduction.)

34555. To establish on **sand and gravel,** carloads, from Massillon, O., to Alliance, O., rate of 50c per net ton, plus emergency charge, to expire with March 31, 1933, unless sooner canceled, changed or extended. (Reduction.)

34588. To establish on **crushed stone,** carloads, from Putnamville, Ind., located on the C. I. & L. Ry., to destinations in C. F. A. territory, rates the same, as currently in effect to Greencastle, Ind.

34607. To establish on **crushed stone, agricultural limestone,** and **crushed stone screenings,** carloads (See Note 3), from Gibsonburg and Woodville, O., to points in Indiana, representative rates as shown in Exhibit A. (Appreciable reductions in most cases.)

EXHIBIT A

To	Prop. rates		Prop. rates
Penna. R. R.			
Atwood	135	Kokomo	155
Decatur	135	Plymouth	145
Ft. Wayne	125	Valparaiso	155
Walkerton (B. & O. R. R.)			155
C. I. & L. Ry.			
Michigan City	165	South Wanatah	165
Oxford (C. A. & S. R. R.)			175
C. C. C. & St. L. Ry.			
Claypool	165	Marion	155
Erie R. R.			
Decatur	135	Rochester	165
Stillwell (Grand Trunk R. R.)			165
N. Y. C. R. R.			
Ft. Wayne	125	Walkerton	155
N. Y. C. & St. L. R. R.			
Argos	145	Kokomo	145
Decatur	125	Michigan City	155
Hartford City	145	Sycamore	145
Michigan City (P. M. R. R.)			165
Wabash Ry.			
Logansport	145	Wolcottville	115

Western Trunk Line

8284. **Sand, silica** (See Note 3), Rates to Blackwell, Okla. (in cents per net ton):

From	Pres.	Prop.
Wedron, Ill.	450	332
Ottawa, Ill.	450	332
Browntown, Wis.	502	356

2692. **Stone, crushed,** carloads (See Note 3), but in no case shall the minimum weight be less than 40,000 lb., from St. Louis, Mo., group to Cedar Rapids, Ia., group. Proposed rate, 12½c per 100 lb. (Reduction). (To apply as a proportional rate on traffic originating at points east of the Illinois-Indiana state line, also Carolina or Southeastern territory.)

8294. **Limestone, ground,** carloads, minimum weight 60,000 lb., from LaSalle, Ill., to Central Freight Association representative points: Evansville, Ind., Terre Haute, Ind., Battle Creek, Detroit and Jackson, Mich., Cleveland, Cincinnati and Youngstown, O., Pittsburgh, Penn. Rates—Present, 6th class; proposed, 60% of 6th class.

Illinois

6985. **Crushed stone, sand and/or gravel,** carloads (See Note 3), but not less than 60,000 lb. per car, from Joliet and Plainfield, Ill., to Marine and St. Jacob, Ill. Rates per net ton. Present rate, no commodity rate published; proposed, $1.39.

6993. **Sand,** carloads (See Note 3), from Pekin and Pit 5 (Crescent), Ill., to Beardstown, Ill. Present rate, 88c per net ton; proposed, 76c.

6995. **Sand and gravel,** carloads, from Chillicothe, Ill., to Springfield, Ill., and intermediate points, viz., Urbandale, Mindale, Evans, Wescart, Crescent, Topeka, Barr, Shops, etc., Ill. Present rate, $1.01 per net ton; proposed, 90c.

7007. **Sand and gravel,** carloads (See Note 3), but not less than 40,000 lb. per car, from Peoria, Ill., to Eleanor, Keithsburg, Little York, Ogle and Seaton, Ill. Present rate, $1.01 per net ton; proposed, 88c, subject to tariff of emergency charges.

7106. **Stone, coated with oil, tar or asphalt (amesite),** carloads (See Note 3), from St. Louis, Mo., to Lawrenceville, Ill. Proposed—$1.88 per net ton (reduction).

7110-A. **Gravel or sand and crushed stone,** from East St. Louis and Falling Springs, Ill., to Shiloh, Ill.:

	Pres.	Prop.
On sand from East St. Louis	65	50
On crushed stone from Falling Springs, Ill.	80	50

7118. **Sand and stone,** from East St. Louis and Krause, Ill., to various points in Illinois. From East St. Louis, Ill., sand, carloads (See Note 3), (applicable only when loaded in M. & O. R. R. equipment). To (representative) East Carondolet, Columbia, Waterloo, Baldwin, etc., Ill. Rates per net ton. Present, 80c; proposed, 60c.

From Krause, Ill., **stone, crushed,** carloads (See Note 3). (Will apply only when loaded in M. & O. equipment.) To (representative) New Hanover, Poe, Griggs, Lemens, Baldwin, Ill. Present, 70c; proposed, 45c.

7134. **Sand, stone,** etc., from Sand, Chester and Kellogg, Ill., to Coulterville, Ill., present 75c, proposed 50c; from Stone-Menard, Ill., to Coulterville, Ill., present 75c, proposed 50c; from Sand, Chester and Kellogg, Ill., to Nashville, Ill., present 80c, proposed 60c.

7139. **Sand and/or gravel** (See Note 3), from Joliet and Plainfield, Ill., to Springfield, Ill. Present, $1.51; proposed, $1.15. Rates per net ton, to expire December 31, 1933. Carload minimum weight, 60,000 lb.

Southwestern

121. **Asphalt rock, stone,** from Texas points to Belleville and Collinsville, Ill. To establish a rate of 23c per 100 lb. on asphalt rock, stone, natural or coated with not to exceed 5% of road oil, crushed or ground, straight or mixed carloads (See Note 1), but not less than 50,000 lb., from Blewett, Cline, Dabney, La., Pryor, Pulliam, Uvalde and Whitesmine, Tex., to Belleville and Collinsville, Ill.

148. **Sand, gravel and crushed stone,** from points in Arkansas, Kansas, Louisiana, Missouri, Oklahoma and Texas to Soldiers Home, Kan. To add the following to Item 160, S. W. L. Tariff 162-E, and Item 250, W. T. L. Tariff 210:

"Rates authorized under this item as applicable on sand, gravel or crushed stone, carloads, to Leavenworth, Kan., will also apply to Soldiers Home, Kan., on the A. T. & S. F. Ry. and be applied as maximum at intermediate points."

258. **Blocks, granite or stone, or crushed** for building and paving purposes, from Austin, Tex., to New Orleans, La. To establish a rate of 21c per 100 lb. on stone for building and paving purposes, straight or mixed carloads, minimum weight 50,000 lb., from Austin, Tex., to New Orleans, La.

Proposed I. C. C. Decisions

Southwestern Lime Rates. A proposal to equip southwestern territory with a lime rate structure based upon, but generally 2c a 100 lb. higher, than western cement scales has been made by Examiner Witters in I. and S. No. 3742, lime from, to and between the southwest. His report also embraces I. and S. No. 3776, lime from, to and between the southwest (2).

He says the Commission should find not justified the rates proposed by the carriers, but without prejudice to the filing of new ones in accordance with his proposals. He also recommends the routine of an order canceling the suspended schedules, covering the southwestern and Kansas-Missouri territories.

The carrier proposal, said Examiner Witters, was to revise the rates, on a minimum of 30,000 lb. to the basis of column 17.5 rates prescribed in Consolidated Southwestern Cases, 123 I. C. C. 203. The principal reason for this revision, he said, was the denial by the Commission in fourth section order No. 10767, of carriers' applications to continue class and commodity rates, including rates on lime, from, to and between points in the southwest without observing the long and short haul provision of section 4. He said the railroads offered no evidence whatever with respect to departures from the fourth section in the present rates. He said that if lime rates were placed on a column basis, fourth section order No. 9600, issued in connection with the Consolidated Southwestern Cases, would automatically afford relief.

According to him the present commodity rates on lime to, from and within the southwest have been in effect a long time and that the records of the Commission do not show a single reported decision involving rates on lime in this territory. The carriers, in 1924, proposed rates for application on lime within the southwest, which were suspended in I. and S. No. 2240. The schedules, he said, were withdrawn after the hearing. The instant proposal, the examiner said, was higher than that of 1924.

Producers of lime in the central west and as far east as Maryland and users in the eastern half of the country protested the plan of the railroads and obtained suspension of the schedules.

25294. Slag. Cash Brothers, Inc., vs. N. Y. N. H. and H. et al., and four subnumbers thereunder, Connecticut Roofing Co. vs. Same, J. J. Moreau and Son vs. B. and M. et al., Glennon Roofing Co. vs. Same; and E. H. Friedrich Co. vs. Same. Rate, slag, since October 30, 1928, from Reading, Penn., to New Haven, Conn., proposed to be found unreasonable to the extent it exceeded $3.20 a ton. Reparation proposed. Rates, same commodity, points in eastern Pennsylvania to points in Massachusetts, Connecticut, and New Hampshire, not shown to have been unreasonable.

25028. Coated Stone. Amiesite Corp. et al. vs. A. C. and Y. et al. and a sub-number, Interstate Amiesite Co. vs. Same. Rates, coated stone, found reasonable from Shaw Junction, Penn., and Youngstown, O., to destinations in New York, Pennsylvania and West Virginia, proposed to be prescribed for application from Pittsburgh and Casparis, Penn., and from Martinsburg, W. Va., to destinations in New York and Pennsylvania on and west of an imaginary line extending north and south through Cumberland, Md., and Cresson, Penn., and in Ohio, West Virginia and Maryland, on a finding that the rates, to the extent they exceed or depart from the rates prescribed in the case cited, will be unjust, unreasonable and unduly prejudicial.

25245. Crushed Stone. Hiddenite Granite Co. vs. Yadkin Railroad Co. et al. Rates, crushed stone, from North Carolina to Virginia and South Carolina points, and between North Carolina points, moving interstate, proposed to be found unreasonable, except those moving over the Atlantic and Yadkin, to the extent they exceeded or might exceed $1.75, $1.65, $1.40 and $1.40, from Mascot, Tenn., to Mt. Airy, Pinnacle, Lincolnton, and Lenoir, N. C., respectively; $1.40 from Strawberry Plains, Tenn., to Olivette, N. C.; $1.40 and $1.35 from Jefferson City, Tenn., to Lenoir and Granite Falls, respectively; $1.20 from Granite Quarry, Tenn., to Leakesville, N. C.; $1 from Hiddenite, N. C., to Filbert and Clover, S. C.; and $1.30 to Patrick Springs, Va., to which, the examiner said, might be added the emergency charges. New rates and reparation proposed.

14716. Slag Fourth Section. Examiner H. C. Lawton, in fourth section application 14716, slag from Pennsylvania, filed by W. S. Curlett, for and on behalf of carriers defendant in National Slag Co. vs. Atlantic City Railroad Co., 181 I.C.C. 699, has recommended that the commission authorize the carriers to establish and maintain, over all interstate routes for the transportation of slag, from origin points in Pennsylvania to destinations in Delaware, Maryland, New Jersey, the Virginias, the District of Columbia and New England, the lowest rates applicable over any line or route, constructed on the bases prescribed in the case mentioned and to maintain higher rates from, to and between intermediate points. The proposed authority is to be subject to conditions.

24840. Sand and Gravel. East Tennessee Sand and Gravel Co. vs. Southern et al. and a sub-number, American Limestone Co. vs. Same. Rates, sand and gravel, Elizabethton, Tenn., were, and rates from Elizabethton and Siam, Tenn., will be unreasonable to the extent they exceeded or may exceed the joint-line basis prescribed in Buckland vs. B. & A., 139 I. C. C. 88, from Bethlehem and Hokendauqua, Penn., to points in New Jersey and New York, applied on traffic to destinations in Virginia. Reparation proposed on shipments from Elizabethton. Examiner also proposed that the commission should find that the maintenance of relatively lower intrastate rates from Petersburg, Va., to Virginia destinations than from Elizabethton and Siam to the same destinations resulted and will result in undue prejudice which should be removed by the establishment of intrastate rates from Petersburg not less than those which would apply under the Buckland scale.

25498. Sand. McLain Fire Brick Co. vs. Pennsylvania. Rate, sand, Mapleton, Penn., to Irondale and New Salisbury, O., unreasonable to extent it exceeded $2.40 a net ton. Reparation proposed.

25161. Silica Sand. Sanistone Products Co. vs. Pennsylvania et al. Rate, silica sand, in bags, Cincinnati, O., to Duluth, Minn., proposed to be found inapplicable; applicable rate proposed to be found not unreasonable but that the charges collected were unreasonable to the extent that they exceeded those that would have accrued on a basis of 72,000 lb. Reparation proposed.

I. C. C. Decisions

25026. Portland Cement. Ash Grove Lime and Portland Cement Co. of Nebraska vs. C. B. and Q. et al. Rates, portland cement, Louisville, Neb., to points in extended cement scale territory 3 in Minnesota and the Dakotas, and to extended cement territory 4 in North Dakota, unreasonable and unduly prejudicial to the extent they exceed or may exceed revised scale 3 rates to extended scale territory in Minnesota and the Dakotas, and revised scale 4 rates to extended cement scale 4 territory in North Dakota, for distances computed according to the method prescribed in Oklahoma Portland Cement Co. vs. D. and R. G. W., 128 I. C. C. 63. New rates to be made effective not later than March 8.

23234. Pigment Media and Plaster. A downward revision not later than February 16, by means of changes in ratings on paint and mortar media and patching plaster, has been ordered in No. 23234, West Coast Kalsomine Co. of New Orleans vs. A. and R. et al., No. 23337, George S. Mepham and Co. vs. A. and S. et al., and No. 23474, Lookout Paint Manufacturing Co. et al vs. Southern et al., from Goodhope (Norco), New Orleans and Baton Rouge, La., East St. Louis, Ill., and Chattanooga, Tenn., to southern and western destinations. New ratings, stated in percentages of first class rates, known as numbered columns, have been ordered based on findings of unreasonableness.

The report by the commission finds unreasonable the carload rates from Goodhope (Norco), New Orleans and Baton Rouge, La., on patching plaster, ochre, graphite, mortar color, whiting and ground iron ore to southern and western destinations. Carload rates from the same points on kalsomine and on dry paints not otherwise indexed by name to southern and western destinations are also found unreasonable.

Less than carload rating on graphite in bags from the same points to western destinations were also found unreasonable, but the less than carload ratings and rates from same points on other commodities named in the complaint to southern and western destinations were found not unreasonable.

Carload rates from East St. Louis to destinations in southwestern and western trunk line territories on mortar color, ground iron ore, ochre, ground barytes, whiting and oxide of iron, in straight or mixed carloads, and on those commodities in mixed carloads with ground gypsum, tripoli, ground soapstone (talc), china clay and silica were also found unreasonable. A like finding of unreasonableness was made as to the carload rates on dry mortar color, ground iron ore and ground barytes from Chattanooga, Tenn., to southwestern destinations.

24949. Cement. Medusa Portland Cement Co. vs. A. & W. et al. Reparation awarded on finding rates, portland cement, Bay Ridge, O., to points in Wisconsin, applicable on certain shipments and inapplicable on others. Applicable rates unreasonable to the extent they exceeded the contemporaneous combination rates made up of the proportional rate of 13c from Bay Bridge to Manitowoc and the rates beyond, both factors being treated by the combination rule.

14796. Dry Building Mortar. Fourth Section Application No. 14796, building mortar, Superior, O., to the south. In fourth section order No. 11069, applicants granted relief from the long and short haul provision of section 4 of the act to enable them to establish and maintain rates on dry building mortar, from Superior, O., to southern destinations named in Jones' I. C. C. No. 2315, the same as the rates contemporaneously in effect on cement, from and to the same points, constructed on the basis of the scale of rates prescribed in Southern Cement Rates, 132

I. C. C. 427, I. C. C. 484, 147 I. C. C. 303, 155 I. C. C. 339, and 176 I. C. C. 747. Relief made subject to the same terms and conditions as contained in outstanding fourth section orders authorizing relief as to rates on cement.

15806. Cement Arbitrary. Lehigh Portland Cement Co. vs. A. and R. et al., a sub-number, Alpha Portland Cement Co. vs. Ashland Coal and Iron Co. Railway, No. 15900, Security Cement and Lime Co. vs. A. and R. et al., and a sub-number, Tidewater Portland Cement Co. vs. Same, collectively known as Southern Cement Rates. Report by Commissioner Eastman. Elkton and Guthrie Railroad Co. found to be under common control and management of the Louisville and Nashville and not entitled to an arbitrary, on cement, not exceeding 2 c., authorized for short or weak lines, other than those that were under common control or common management of some standard carrier, in the original report, 132 I. C. C. 427. This reopened or further proceeding was on petition of the L. and N. for authority to add an arbitrary to the standard rates on traffic going to stations on the Elkton and Guthrie, in which it held more than one-third of the capital stock, operated all trains and acted, as it claimed, merely as agent of the Elkton and Guthrie. The commission said that the interest of the L. and N. was much greater than that of a mere agent.

14773. Cement. Cement from Dixon, Ill. In fourth section order No. 11077, circuitous lines authorized to establish and maintain rates, cement, Dixon, Ill., to St. Paul, Minnesota Transfer and Minneapolis, Minn., the same as those in effect on like traffic over the short lines, subject to the condition that the rates from, to and between the higher rated intermediate points shall not exceed those constructed on the basis of Scale II prescribed or approved in Western Cement Rates, 48 I. C. C. 201, 52 I. C. C. 225, 69 I. C. C. 644 and 132 I. C. C. 273, and the standard circuity rule; provided that in those instances in which the use of a rule or rules showing rates and maximum distances, in lieu of specific routing, in accordance with the method approved in Brick and Clay Products in the South, 113 I. C. C. 380, is authorized, the relief herein granted shall apply even though the degrees of circuity specifically set forth herein may be exceeded. A further condition is that in complying with the conditions of the preceding sentence distances to and from points that are not basing points may be disregarded and distances to and from points on which they base may be used in lieu thereof.

24705. Dolomite. Owens-Illinois Glass Co. vs. B. & O. et al. Rates, raw or crude dolomite, McVitty's, O., to Fairmont, W. Va., on and after February 12, 1930, were, are and for the future will be unreasonable to the extent they exceeded, exceed or may exceed $2.10 a net ton. Rate after January 4, 1932, subject to emergency increases under Ex Parte 103. Reparation awarded. Commissioner Lee dissented from the award of reparation to a basis lower than a rate of $2.65. Order for future effective on or before February 9, 1933.

14687. Cement Fourth Section. Cement from Rapid City, S. D. Applicants, parties to Boyd's I. C. C. A-2179, authorized, in fourth section order No. 11079, to establish rates, cement, Rapid City to points in western Minnesota, the lowest applicable on like traffic via the direct lines or routes, constructed on the basis of distance Scale IV, prescribed in Western Cement Rates, 48 I. C. C. 201, 52 I. C. C. 225, 69 I. C. C. 644 and 132 I. C. C. 273.

14817. Asphalt Rock Fourth Section. Asphalt rock from New Mexico. Upon further consideration fourth section order No. 11099, authorizing relief in rates on crushed or ground asphalt rock from Los Tanos and Santa Rosa, N. M., to points in Arkansas, Colorado, Kansas, Missouri, Nebraska, Oklahoma and Texas, modified so as to include rates from Hawks, N. M., a point intermediate to Los Tanos and Santa Rosa.

24626. Cement. Lone Star Cement Co., Alabama, vs. A. T. & S. F. et al. Rates, cement, Spocari, Ala., to points in Missouri, Oklahoma and Texas, in scale III and IV territories, unreasonable to the extent that they exceeded the respective scale III and scale IV rates prescribed in Oklahoma Portland Cement Co. vs. D. & R. G. W., 128 I. C. C. 63, familiarly known as the Texas case, computed on distances over the actual route of movement. The commission said that if in the period covered by the complaint there were combinations applicable over the routes of movement lower than the rates determined in the manner described, such combinations should be substituted for the rates resulting from the application of the scales.

Consider Switching Rate Complaints

THE most important matter to come before the public hearing of the newly organized Louisiana Public Service Commission at a recent meeting consisted of three complaints of the Parker Gravel Co. against the Louisiana and Arkansas, the Missouri Pacific and the Y and M. V. railroads, for overcharges switching refunds, in the amount of over $75,000.

Chairman Fields stated during the discussion that in the event these complaints were sustained, more than $5,000,000 of such claims would have to be adjusted.

All of the railroads filed exceptions to the complaints excepting to the jurisdiction of the Public Service Commission and all of the exceptions were argued. The parties to the matter were given 20 days in which to file briefs, after which the commission will dispose of the matter.—*Alexandria* (La.) *Town Talk.*

Opposes Higher Industrial Sand Rate

HIGHER freight rates on industrial sand proposed by the Interstate Commerce Commission would drive much business from the rails to water carriers, the Libbey-Owens-Ford Glass Co., maintained in a petition to the commission for a rehearing on the rates, filed recently.

Economic necessity will force the company to haul its glass sand to the Rossford, Ohio, plant by water rather than rail if the new rates go into effect, the company stated.

It was declared that during 1932 much of the 54,300 tons of sand used in polishing and grinding plate glass at Rossford and East Toledo plants was brought in by boat. This sand comes from Michigan.—*Toledo* (Ohio) *Times.*

Withdraws Petition to Reduce Gravel Rates

PETITION of the Mississippi Sand and Gravel Co. to reduce sand and gravel rates in Mississippi was withdrawn by the company recently.

New Publications of the Month

Silica in 1931—Statistical data on silica published by the Bureau of Mines.

Mineral Production of the World, 1924-1929—A complete summary of all mineral production of the world, by country, published by the Bureau of Mines.

Surface Treatment Types of Asphalt Road Construction—Manual No. 2 of a series showing best engineering practice in meeting surface treatment requirements. Asphalt Institute, New York, N. Y.

Specifications for Liquid Asphaltic Road Mixes—Contains newly simplified specifications as recommended by the Asphalt Institute, New York, N. Y., from whom copies are available.

Proceedings of Technical Sessions of Association of Asphalt Paving Technologists—Proceedings include paper and discussion of some fundamental physical characteristics of mineral filler intended for asphalt paving mixtures.

Feldspar in 1931—Statistical data on feldspar published annually by the Bureau of Mines.

Investigations of Mineral Resources and the Mining Industry of Canada in 1931—Includes studies on "Suitability of Certain Sands for Sand Blasting"; "Raw Materials for Manufacture of Rock Wool in Niagara Peninsula"; "Exploration of Bituminous Sand Areas in Northern Alberta"; "Recent Progress in Commercial Separation of Bitumen from Bituminous Sands"; "Estimated Cost of Producing Solid and Liquid Hydrocarbons from Bituminous Sands"; and "Quartzite from Sunnybrae." Canadian Department of Mines, Ottawa, Canada.

Method and Cost of Mining Sand and Gravel at the Atlas Sand, Gravel and Stone Co.—Information Circular 6676 issued by the Bureau of Mines describes operation of the Farmington, Conn., plant, reviewing geology and detailed operating system, including summary of costs in units of labor, power and supplies.

Core Drilling in Salt Beds of Texas and New Mexico—Information Circular 6679, issued by the Bureau of Mines, gives supplementary notes on core drilling in the salt beds of western Texas and New Mexico. The chief subjects covered are drilling practices and drilling notes on individual tests.

Analyses of Montana Coals

A PHYSICAL and economic analysis of Montana coals has been made by the Bureau of Mines. This has been published as Technical Paper 529.

Design and Testing of Asphaltic Paving Mixtures

(Abstracted by Edmund Shaw, Contributing Editor, Rock Products)

IN A PAPER delivered before the British Society of Chemical Industry, and published in the Society's Transactions for December, 1932, Norman H. Taylor gives the results of a very exhaustive research in bituminous paving mixtures and the materials for making them. The article describes a new type of stability testing device. The specimen, a disk 4½-in. in diameter and 1½-in. thick, is laid on the ram of a hydraulic press. A plunger, 2-in. in diameter, is placed centrally on the disk and while pressure is applied from below by pumping, a counter-balancing pressure is applied to the plunger by running sand into a box attached to the plunger by a lever system. The lateral pressure breaks the ring of material which is outside the plunger. In the tests given the pressures applied run from 750 to 2100 lb.

Mixtures which would not rut or wave, would resist weathering and would not polish under traffic and were yet sufficiently plastic to conform to slight movements of the subgrade without cracking, in the climate of Singapore, where the tests were largely made, were found to meet the following conditions: The stability of the mixture was not less than 1400 lb. nor more than 2500 lb. The voids in the mixture did not exceed 4%. The bitumen did not show excessive alteration in its properties after the volatilization test. The sand had the following grading:

0- 5% passing 200 mesh.
10-35% passing 80 mesh.
25-45% passing 40 mesh.
10-25% passing 10 mesh.

The stone grading was:

21.2% passing ¼ in.
38.4%, ¼-in. to ½-in. size.
40.4%, ½-in. to ¾-in. size.

Limestone and clay were used as fillers, cement being ruled out on account of its cost. One bitumen tested which showed a high loss on heating was judged unsuitable for tropical conditions.

Production of Canadian Nonmetallics, 1932

THE VALUE of Canada's nonmetallic mineral production in 1932 is estimated as follows, in part, by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics at Ottawa:

ESTIMATED PRODUCTION IN 1932

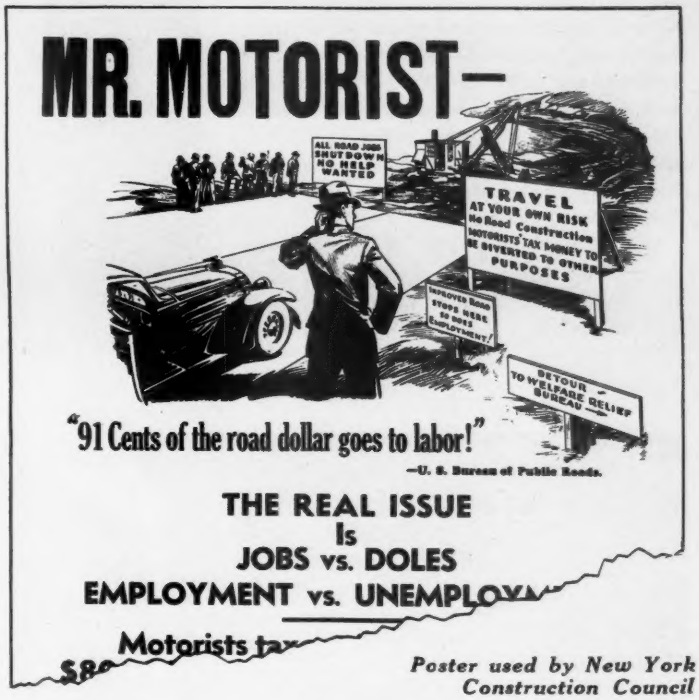
		Quantity—1931	—Value	Quantity—1932	—Value
Asbestos	tons	164,296	$ 4,812,886	118,407	$2,897,000
Feldspar	tons	18,343	186,961	5,776	71,000
Gypsum	tons	863,752	2,111,517	485,205	1,178,000
Quartz	tons	195,724	303,158	145,839	217,000
Talc and soapstone		....	157,083	....	158,000
Other nonmetals		....	1,417,387	....	1,102,000
Cement	bbl.	10,161,658	15,826,243	4,555,261	6,997,000
Lime	tons	344,785	2,764,415	319,945	2,199,000
Stone and sand and gravel		....	17,726,349	....	9,500,000

Slate Industry in 1932

SLATE sold at the quarries of the United States in 1932 was approximately 272,400 short tons, valued at $2,990,000, according to estimates by the Bureau of Mines. This was a decrease of 26% in quantity and 46% in value from the output for 1931.

Continues Fight for Gas Tax Funds

CONTINUING its aggressive fight for the construction industry, the New York Construction Council, Inc., Rochester, N. Y., has recently provided its members with posters which have received broad distribution as a result. The illustration, which originated in Connecticut, tells an effective story of the road construction dollar and the effect diversion has on the taxpayer. The copy on the poster, only part of which is shown in the accompanying illustration, originated with the New York Construction Council. An effective illustration, combined with a vivid word picture, is bound to win sympathetic support by the entire public. The poster reads as follows:



Poster used by New York Construction Council

"The real issue is jobs vs. doles, employment vs. unemployment. Motorists' taxes will yield between $80,000,000 and $90,000,000 this year. These special taxes should be spent on roads for direct relief of the unemployed.

"There are miles of employment—if there is no diversion of motorists' taxes. Let's give our unemployed citizens a chance in 1933. You can help!

"Tell your state and county officials, and your legislators, that you want all motorists' taxes used to provide real jobs of honest toil on lasting and useful public improvements."

The New York Construction Council is to be congratulated on this aggressive effort.

W. H. L. McCourtie

WITH the passing on February 6 of W. H. L. McCourtie, the cement industry lost one of its best known and most picturesque characters. For many years he had been president of the Trinity Portland Cement Co. with plants at Dallas, Fort Worth and Houston, Texas.

On his graduation from the University of Michigan, Mr. McCourtie practiced law in Jackson, Mich., and later became interested in cement companies located in Michigan, Iowa, and Kansas. His particular interest finally centered in the Trinity Portland Cement Co., of which he became a director and later, in 1916, president.

Mr. McCourtie also acted as president of the Northwestern States Portland Cement Co. for one year, taking up these duties in December, 1928. He remained as president of Trinity until November, 1932. He was then suffering from an illness which confined him to a sanitarium at Battle Creek for six months prior to his death and where he passed away. He was 61 years of age.

Mr. McCourtie was famous throughout the country as a lover of horses and for his interest in horse racing. He is survived by his widow and one son, Wendell.

Industrial Research Laboratories

THE Research Information Service of the National Research Council is preparing a revision of its "Industrial Research Laboratories of the United States, including Consulting Research Laboratories," the fourth edition of which was published in 1931.

Data included are name and address of the firms, the research directors and the research problems engaging the attention of the laboratories.

Ash Grove Celebrates Triple Anniversary

IN HONOR of the completion of 50 years in business by the Ash Grove Lime and Portland Cement Co., 25 years of operation by the Chanute plant and one calendar year without lost time accident at the plant, an unusual celebration was held at Chanute, Kan., on November 26.

Company Organized Fifty Years Ago

The Ash Grove company was organized in 1882. For the first 25 years it engaged exclusively in the manufacture of White lime at its plant at Ash Grove, Mo. Later it established another lime plant at Galloway, Mo., and portland plants at Chanute, Kan., and Louisville, Neb., the former in 1907 and the latter in 1928. At the present time, in addition to lime products and standard portland cement it manufactures "Quickard," a high early strength cement developed largely by its veteran operating vice-president, Andrew Lundteigen.

Twenty-five years ago the Ash Grove management built its portland cement plant at Chanute. The Chanute plant has enjoyed almost continuous demand sufficient to permit at least partial operation, from its opening until the present period of business slack.

L. T. Sunderland

Accident prevention work, always an important feature with the company, has been carried on intensely at the Chanute plant for many years. During the past seven years particularly, its record has been an envious one. In 1931 it succeeded in completing a calendar year without the loss of a day's time on the part of any employe through accident. Likewise 1932 was free from mishap, making a total of 757 consecutive accident-free days up to November 26.

New Type of Trophy Created by Company

In honor of the plant's excellent safety and general operating record the Ash Grove company created a trophy in the shape of an ornamental concrete safety island and lighting standard towering above which is a graceful flag pole.

Guy O. Gardner, superintendent who recently completed 20 years of service at the plant, gave the address of welcome. The trophy was presented by T. Sunderland, president of the company, and unveiled by K. W. Wight and Dan Gardner. Acceptance of trophy was by O. D. Nelson, chairman of the plant safety committee. Short ad-

Chanute, Kansas, plant of Ash Grove Lime and Portland Cement Co.

Guy O. Gardner

Chanute plant trophy

dresses were made by A. K. Frolich, superintendent of the Louisville plant of the company; Dr. L. D. Johnson, and A. A. Gist, division superintendent of the Santa Fe.

Accidents in Quarry Industry

REPORTS on accident prevention records in the quarrying industry of Georgia, Indiana, Missouri, Maryland, Tennessee, West Virginia, Kentucky and Ohio in 1931 have been issued by the Bureau of Mines. These reports include those engaged in crushing and dressing rock, and the manufacture of cement and lime.

Wire Diameters for Screens Used by Aggregate Industry to Be Standardized

IN COOPERATION with the aggregate industry and the Division of Simplified Practice of the U. S. Department of Commerce, manufacturers of wire screen have undertaken preliminary studies looking toward a reduction in the number of sizes of wire used in the manufacture of wire screens for the aggregate industry.

The large number of wire diameters listed in the catalogs of wire screen manufacturers leads inevitably to one of two conclusions: (1) either screening requirements vary over an extremely wide range and are sensitive to microscopic changes in sizes of wire, or (2) a very much larger number of wires are listed than practical considerations dictate. Undoubtedly, there is an element of truth in both of these conclusions. Wire screen manufacturers serve several different industries and the requirements for each of them are different. Unfortunately catalogs of wire screens do not attempt to classify the different sizes of wire according to the industry to be served, and, consequently, there results considerable confusion in each industry as to what sizes will best meet its requirements.

This condition was called to the attention of the National Sand and Gravel Association by certain of its active and associate membership. It was suggested that large economies to the manufacturer of wire screens and to the producer of aggregates might be effected by efforts directed toward the standardization and simplification of sizes of wire. It was pointed out that the selection of sizes best adapted to the needs of the aggregate industry would result in a reduction of the stock necessary for the manufacturer to carry and would lead to the more general use of the most efficient sizes.

The National Sand and Gravel Association felt that this was an important problem but that it was particularly one of the manufacturer. The association initiated correspondence with manufacturers of wire screen for the purpose of determining their viewpoint on the problem and, as a result, a meeting of representative wire screen manufacturers was held in August, 1931. That meeting discussed the problem in detail and agreed that a great deal of benefit would result from a suitable reduction in sizes. It made a tentative selection of diameters of wire for consideration of manufacturers and users of wire and producers and users of aggregates. These sizes are outlined in Table 1.

The problem was then presented to representatives of the National Crushed Stone Association and the National Slag Association and their cooperation enlisted. After a careful consideration of the best procedure for obtaining a full discussion of the suitability of these sizes from all interested branches of the industry, it was decided to enlist the cooperation of the Division of Simplified Practice of the Department of Commerce. This division is set up as a clearing house and disinterested coordinating body to endeavor to eliminate industrial waste. Its function is to assist industry to find and promote the best thought and practice in connection with given commodities, and to secure the cooperation of manufacturers, distributors and users and others concerned with a particular commodity. The division has no police or regulatory powers and acts only at the request of a substantial majority of the industry.

The Division of Simplified Practice has agreed to cooperate in this project. Preparations are under way for calling a general conference, the date for which has not yet been selected. While notice of its date and purpose will be sent by the division to all concerned, this general announcement through the press and others which will follow should be accepted as indicating the urgent desire of the industry that all who have a direct or indirect interest in the movement will either be in attendance at the conference or represented through their associations. Comments and suggestions on the proposed sizes, by those unable to attend, will be received by the Division of Simplified Practice, Bureau of Standards, Washington, D. C., and will be brought to the attention of the general conference.

Talc and Soapstone

DATA on talc and soapstone in the United States in 1931 are contained in a bulletin issued by the Bureau of Mines. Uses, trends, producers and prices are discussed.

TABLE 1. TENTATIVE SELECTION OF SIZES OF WIRE SCREENS MOST ADAPTABLE TO THE AGGREGATE INDUSTRY

Width of clear openings, inches	Diameter of wire, inches				
⅛	0.041 (6-mesh)	0.047 (6-mesh)	0.072 (5-mesh)	0.092 (4½-mesh)	
3/16	0.063 (4-mesh)	0.105	0.120	0.135	
¼	0.080 (3-mesh)	0.105	0.120	0.135	0.162
5/16	0.105	0.120	0.148	0.177	
⅜	0.120	0.148	0.192	....	
7/16	0.148	0.192	....	....	
½	0.135	0.162	0.192	0.207	
⅝	0.148	0.162	0.177	0.207	
¾	0.162	0.177	0.192	0.250	
⅞	0.177	0.207	0.225	0.250	0.375
1	0.192	0.250	0.3125	0.375	
1⅛ to 1¼		0.250	0.3125	0.375	
1⅜ to 1½		0.250	0.3125	0.375	0.4375
1¾ to 2		0.3125	0.375	0.4375	0.500
2¼ to 2¾		0.375	0.500	0.625	
3 to 3¾		0.500	0.625	0.750	
4		0.500	0.625	0.750	1.000
Over 4 to 6½		1.000	1.125	....	

Ed. Shaw's News Letter from Los Angeles

A New Method of Vibrating Concrete and Its Effect on Aggregate Specifications — "Bootlegging" Sand

STANLEY HANDS, of the California State Highway Department, took me to see how the concrete was being placed on a new bridge the state is building near Ventura. The method is called "internal vibration," and the device that does it on this job looks like a 3-ft. piece of 2½-in. pipe on the end of a hose. The hose contains a flexible shaft and inside the pipe there is an eccentric that vibrates the pipe rapidly and hard enough so that a man cannot stand on it when it is lying flat.

The method has passed the experimental stage and Mr. Hands expects that it will be standard for similar work in the future. This would not interest us particularly if it were not that it promises to have considerable effect on the aggregate industry. The device, or a similar device, will be used because it saves considerable labor in placing the concrete, if for no other reason.

Provides for "Under-Sanded" Mixtures

The method demands somewhat stiffer mixes than are used with hand placing, and of course it not only permits but demands a lower water-cement ratio. In this case the water-cement ratio was lowered from 0.81 to 0.74, the slump being about 1½ in. The mix is 24% sand, 4% pea gravel, 28% No. 4 to ¾-in. and 44% ¾- to 1½-in. At times the sand is as low as 21%. The pea gravel is omitted if the coarse aggregate tends to "come up."

Until this internal vibration was adopted the tendency was rather toward over-sanded mixtures, but with the internal vibration the tendency is toward under-sanded mixtures. And the practice in regard to pea gravel is significant. The work of C. A. G. Weymouth, of Los Angeles, which is described elsewhere in this issue of ROCK PRODUCTS, has shown that the bad effects of certain gradings is due to what he calls "particle interference," which means that there is not room between the large particles for the small particles to circulate freely and find the places where they will lie so as to make the densest concrete. One way of overcoming particle interference is to leave out some of the medium sized grains to give larger spaces between the larger grains. Mixes are being designed on that basis now by some engineers. If the practice spreads it will give the ever-harassed aggregate industry a new condition to meet. But, undoubtedly, they will meet it as they have met so many new conditions in the past.

The girders and the deck are being poured simultaneously on this job, instead of with the usual 5-day wait. This allows all the settling to take place while the concrete is fluid, or at least green enough so that the movement will do no harm. In some future jobs it is proposed to pour piers, girders and deck in one continuous pour, making a really rigid monolithic structure between expansion joints. This will demand either that the materials be ready on the job or that the delivery be so well organized that there will not be the slightest danger of delay, and this also interests the producer.

You may remember that in the issue of ROCK PRODUCTS for August 29, 1931, Mr. Hands described the finding of the water requirements of the different materials of concrete and the finding of what he calls the "water index" of each. From these water indices he calculates the percentages of sand and coarse aggregate that would give the most workable mix, the water-cement ratio, and consequently the quantity of water to be fixed at the start. He showed me how this calculation is made and said that it has been pretty thoroughly checked by laboratory methods. It is to be hoped that he can find time to write an article soon and give us the latest results with his method.

Bootlegging Sand

This seems to be an age of bootlegging. And the bootlegging of certain grades of sand I find to be a very common practice, almost universal except in highway and other work for which state, city and county have their own specifications.

The trouble comes from that section of the building ordinance which relates to sand and reads:

Sec. 175-F. Sand should be deemed to be bank or river sand or finely divided rock of any hard variety passing a ¼-in. screen, which shall not contain more than 5% by volume of loam, silt, mica and organic matter, and not more than 30% shall pass a 30-mesh screen. The gradation from fine to coarse shall be uniform.

This is indeed a sweet specification! A producer might use either a ¼-in. round hole or a ¼-in. square hole sieve for his limiting size, and both are in use here. The city engineering department uses the round-hole sieve, although common practice is the other way. It also appears that one might confidently offer a sand which had 4.99% of organic matter—garbage, say—so long as it had no mica, loam or silt. The one point on which the ordinance is definite is that not more than 30% shall pass a 30-mesh sieve, and it is because of this that so much sand is bootlegged.

I am told that this section was copied from some eastern highway concrete specification, written to prevent too much fine sand being used in highway concrete. Neither strength, plasticity nor the ability to take a good finish was considered at the time, when many such specifications were written. But we have learned that workability and finishability are more important than strength in many structures and in all exposed surfaces, and these qualities cannot be had with our local angular sands unless the minus 30-mesh *exceeds* 30%.

So it is a common thing for the small contractor to throw a few shovelfuls of any dirt or fine sand that is handy into the mixer, and large contractors sometimes buy fine sand and add it while the inspector politely looks the other way. A curious phenomenon was noted while a very large public building was going up. Architects, engineers, contractors and everyone else believed that if this sand section were lived up to the job would not finish well. The concrete and materials were sampled every thousand yards, and on the days when the sampling was done there was no sand furnished that would not meet this not more than 30% minus 30-mesh specification. But the finish is excellent!

No one, producer, architect, engineer or contractor, likes such a state of things, and some attempts have been made to remedy it. Not so long ago a representative of one of the large producers asked a body of engineers to use its influence to have the ordinance changed. One of his hearers intimated that perhaps his company wanted to sell a little more fine sand, not understanding that a man may sometimes advocate something even though he does not expect to make any money from it.

I have talked with representatives of producers, contractors and of cement manufacturers, and they all say that the ordinance should be changed. One man who has given the matter much study suggests a minimum of 25% and a maximum of 45%. The city specifications for public works permit 17% to 42%, but the 17% minimum is admittedly too low.

Proceedings of A. S. T. M. Meeting

THE proceedings of the 35th annual meeting held at Atlantic City, N. J., June 20-24, 1932, have been published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Penn., as volume 32. Part 1, consisting of 1070 pages, covers committee reports and tentative standards, and Part 2, comprising 824 pages, gives the technical papers.

Lime Industry in 1931

THE LIME sold by producers in the United States in 1931 amounted to 2,707,614 short tons, valued at $18,674,913, according to figures compiled from reports made by lime manufacturers. This represents a decrease of 20% in quantity and 27% in value as compared with 1930. Sales of hydrated lime, which are included in these figures, amounted to 1,119,266 tons, valued at $7,729,047, a decrease of 16% in quantity and of 25% in value. The average unit value of all lime showed a decrease from $7.56 a ton in 1930 to $6.90 in 1931, and that of hydrated lime a decrese from $7.79 a ton in 1930 to $6.91 a ton in 1931.

Sales of lime used in the manufacture of chemicals—1,463,217 tons, valued at $9,810,514—decreased 20% in quantity and 26% in value; lime sold for construction—947,085 tons, valued at $6,940,250—decreased 21% in quantity and 31% in value: and agricultural lime—297,312 tons, valued at $1,924,149—decreased 13% in quantity and 19% in value.

Ohio, the largest producing state (656,441 tons, valued at $4,007,004 in 1930), showed a decrease of 11% in quantity reported, and Pennsylvania (497,258 tons, valued at $3,378,088 in 1930), decreased 23% in quantity. The total number of plants that reported operations in 1931 was 345, 30 less than in 1930. Although lime manufacturing plants are distributed throughout the United States, there is much interstate shipment, and the accompanying table shows the total sales, shipments into and from the different states, and per capita consumption.

Of the hydrated lime sold by producers in the United States in 1931, Ohio produced 426,144 short tons (10% less than in 1930). Of this, 373,464 short tons (88%) was sold for construction and was widely distributed throughout the continental United States. The table shows tonnage distribution of hydrated lime from plants in the United States and in Ohio, as reported to the Bureau of Mines, presented for blocks and contiguous states roughly comprising various freight-rate zones for 1930 and 1931.

Lime exported from the United States in 1931, according to figures supplied by the Bureau of Foreign and Domestic Commerce, amounted to 11,923 short tons, valued at $129,943, a decrease of 18% in quantity and 32% in value compared with 1930. Lime (hydrated and "other" lime, exclusive of dead-burned dolomite) imported for consumption amounted to 14,458 short tons, valued at $181,867, a decrease of 30% in quantity and 33% in value. Hydrated lime imported decreased 32%, "other" lime decreased 30%.

SHIPMENTS OF HYDRATED LIME FROM PLANTS IN THE UNITED STATES

Destination	From all plants: Short tons	From all plants: Distribution	From Ohio plants: Short tons	From Ohio plants: Distribution	From Ohio plants: Group total
1930					
Illinois, Indiana, Michigan, Ohio	297,068	22.3%	200,238	42.4%	67.4%
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	562,678	42.3	181,591	38.5	32.3
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	71,182	5.4	22,040	4.7	31.0
Florida, Georgia, North Carolina, South Carolina, Virginia	103,144	7.8	20,553	4.4	19.9
Alabama, Kentucky, Louisiana, Mississippi, Tennessee.	51,076	3.8	12,869	2.7	25.2
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin	169,610	12.8	23,892	5.1	14.1
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	57,416	4.3	2,901	0.6	5.1
Undistributed and exports	17,388	1.3	7,701	1.6	44.3
	1,329,562	100.0%	471,785	100.0%	35.5%
1931					
Illinois, Indiana, Michigan, Ohio	264,106	23.6	169,835	39.9	64.3
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	472,837	42.2	182,475	42.8	38.6
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	54,810	4.9	14,071	3.3	25.7
Florida, Georgia, North Carolina, South Carolina, Virginia	82,378	7.4	14,193	3.3	17.2
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	42,630	3.8	10,587	2.5	24.8
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin	137,437	12.3	24,184	5.7	17.6
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	46,941	4.2	2,723	0.6	5.8
Undistributed and exports	18,127	1.6	8,076	1.9	44.6
	1,119,266	100.0%	426,144	100.0%	38.1%

LIME SOLD BY PRODUCERS IN THE UNITED STATES, 1930 AND 1931, BY USES

Use	1930 Short tons	1930 Value	1931 Short tons	1931 Value
Agricultural	343,111	$ 2,372,779	297,312	$ 1,924,149
Building	1,204,614	10,050,270	947,085	6,940,250
Chemical:				
Glass works	62,912	408,429	59,148	345,780
Metallurgy	415,692	2,371,222	290,352	1,714,368
Paper mills	378,721	2,652,232	286,745	1,781,793
Refractory lime (dead-burned dolomite)	351,740	3,045,082	243,769	1,866,971
Sugar refineries	18,905	238,788	18,185	211,625
Tanneries	56,526	438,869	54,604	372,321
Other uses	555,659	4,038,815	510,414	3,517,656
Total chemical	1,840,155	$13,193,437	1,463,217	$ 9,810,514
	3,387,880	$25,616,486	2,707,614	$18,674,913
Hydrated lime (included in above totals)	1,329,562	10,357,445	1,119,266	7,729,047

LIME SUPPLIES AVAILABLE FOR CONSUMPTION IN THE UNITED STATES IN 1931

State	Sales by producers	Shipments from state	Shipments into state	Supply: Hydrated	Supply: Quicklime	Supply: Total	Lb. per capita
Alabama	137,423	38,515	3,881	10,473	92,316	102,789	77
Arizona	22,567	9,379	90	1,095	12,183	13,278	60
Arkansas	22,520	13,750	2,718	4,066	7,422	11,488	12
California	41,371	4,495	21,739	19,996	38,619	58,615	20
Colorado	4,646	566	6,275	4,004	6,351	10,355	20
Connecticut	(*)	(*)	19,813	12,313	13,040	25,353	31
Delaware	....	....	27,727	13,089	14,638	27,727	231
District of Columbia	....	....	13,522	12,052	1,470	13,522	55
Florida	(*)	(*)	17,582	13,751	12,051	25,802	34
Georgia	5,139	1,307	20,272	18,191	5,913	24,104	17
Idaho	880	686	864	409	649	1,058	5
Illinois	96,105	43,597	92,780	60,061	85,227	145,288	38
Indiana	81,925	49,864	44,232	39,771	36,522	76,293	47
Iowa	(*)	....	(*)	15,028	27,807	42,835	35
Kansas	....	....	26,041	16,013	10,028	26,041	28
Kentucky	(*)	(*)	26,119	8,203	18,711	26,914	20
Louisiana	....	....	45,520	7,550	37,970	45,520	43
Maine	28,157	10,748	27,297	11,839	32,867	44,706	112
Maryland	36,445	14,512	45,612	39,225	28,320	67,545	82
Massachusetts	123,607	93,744	34,928	20,445	44,346	64,791	30
Michigan	46,716	30,327	95,176	55,256	56,309	111,565	45
Minnesota	(*)	(*)	8,952	11,788	9,499	21,287	17
Mississippi	....	....	10,686	3,517	7,169	10,686	11
Missouri	224,416	170,771	18,148	27,854	43,939	71,793	39
Montana	2,028	409	1,170	1,670	1,119	2,789	10
Nebraska	....	....	7,696	5,518	2,178	7,696	11
Nevada	(*)	(*)	1,121	733	1,220	1,953	42
New Hampshire	....	....	10,218	3,263	6,955	10,218	44
New Jersey	(*)	....	(*)	87,711	47,762	135,473	66
New Mexico	(*)	(*)	9,736	1,209	9,811	11,020	51
New York	49,574	25,925	273,412	150,900	146,161	297,061	47
North Carolina	(*)	(*)	44,531	18,759	27,855	46,614	29
North Dakota	....	....	5,928	4,718	1,210	5,928	17
Ohio	656,441	450,328	65,277	109,018	162,372	271,390	81
Oklahoma	....	....	17,559	10,620	6,939	17,559	14
Oregon	(*)	(*)	8,256	4,751	3,907	8,658	18
Pennsylvania	497,258	214,658	148,545	157,914	273,231	431,145	89
Rhode Island	2,042	492	10,222	5,694	6,078	11,772	34
South Carolina	....	....	12,918	7,850	5,068	12,918	15
South Dakota	2,682	....	1,451	1,848	2,285	4,133	12
Tennessee	113,268	90,237	9,793	12,887	19,937	32,824	25
Texas	45,553	11,342	2,626	24,674	12,163	36,837	12
Utah	18,192	935	239	3,144	14,352	17,496	68
Vermont	30,226	27,823	976	1,256	2,123	3,379	19
Virginia	100,659	66,422	34,061	23,827	44,471	68,298	56
Washington	20,619	6,861	1,948	2,521	13,185	15,706	20
West Virginia	170,420	149,082	50,082	11,946	59,474	71,420	82
Wisconsin	42,621	12,253	51,580	21,876	60,072	81,948	55
Wyoming	....	....	1,916	843	1,073	1,916	17
Undistributed	65,480	32,879	177,198	....	....	....	....
	2,688,980	‡1,571,907	1,558,433	1,101,139	1,574,367	2,675,506	43

†Based on Bureau of the Census preliminary statement. *Included under "Undistributed. ‡Includes 13,474 tons of lime exported or unspecified by producers as to destination.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Opens New Market for Concrete Roof Tile

WITH the realization that the large volume of roofing business was in the price range of wood and asphalt shingles, Otto Walter, pioneer manufacturer of roofing tile machinery, Perrysville, Ind., early in 1930 set to work to develop a method whereby concrete tile could be made and sold to compete for this business.

With hand machines in use at that time production costs were too high to permit competition for such business at a price with a satisfactory profit. Mr. Walter realized that some method must be devised for mass production that would bring the cost of concrete shingles to a point far below any possible cost of that time.

Having no preconceived plan but with the determined conviction that more than 40 years of concentration on manufacturing and improving concrete tile qualified him to overcome all obstacles, he set about his task. Time after time his investigations failed to give the result he was hunting. Probably few men would have held as resolutely to an objective as did Mr. Walter. And it is probably to this unswerving determination that the announcement of the successful development of a tile machine meeting the requirements initially set for it is possible.

According to Mr. Walter, concrete tile can be made on this new machine at a price that it can be sold in competition with wood and asphalt shingles, including a very satisfactory profit. This low cost is the result of mass production, the machine making 150 tile per minute. Only one operator is required for the machine. After they are manufactured they are cured and stacked in the yard, the only manual handling required.

Tile can be manufactured in a number of styles, and methods have been devised to manufacture specials at a much lower cost than is possible with present methods. Extreme accuracy is obtained with all details, dimensions of tile being controlled within 0.010 in. Even the location of nail holes is held within this limit.

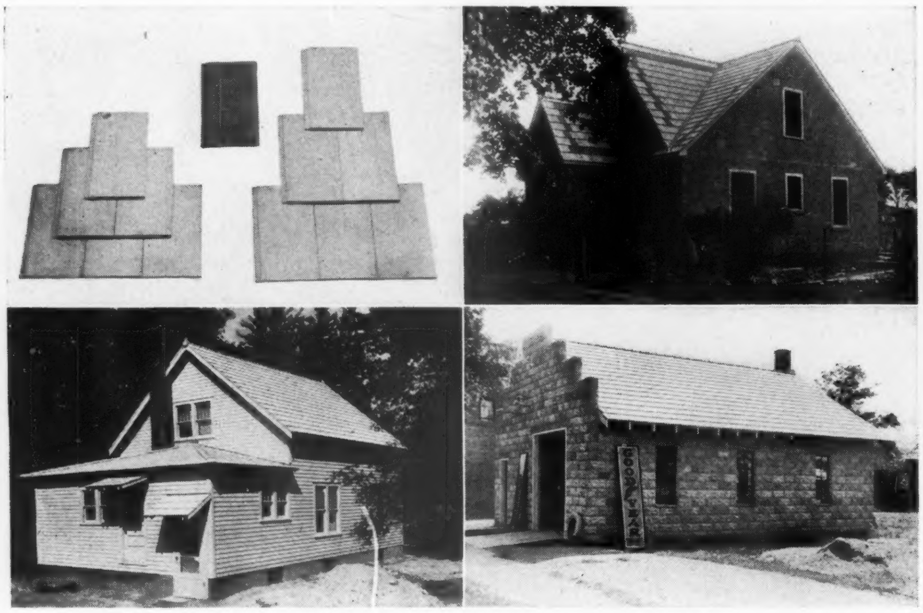
The English style interlocking concrete shingle tile shown in accompanying illustrations measures 9¼ by 15 in. and the exposed tile when in place measures 8½ by 12 in. This type of tile weighs from 560 to 750 lb. per square, depending on the aggregate used.

In describing the development of this machine Mr. Walter explained that quality of finished tile was one of the problems that made his task much harder. The tile must be perfect in every respect and it is the excellence of the finished tile in which he takes the greatest pride. Not satisfied with visual appearance, tests were carried out; tests which were as near actual conditions of use as the laboratory could reproduce.

Water was sprayed on the upper surface of the tile for approximately six hours. The tile was then put in a refrigerator at 10 deg. F. for 18 hours. This cycle was repeated every 24 hours for 25 times, after which it is reported that there were no signs of disintegration. The tile was then placed in a horizontal position with the grooves up, and the grooves were filled with water. At the end of four days there was no sign of water on the under side of the tile. These tests confirmed Mr. Walter's judgment on the quality of the tile.

It is with much enthusiasm that he reflects on the tremendous market which he has opened to concrete tile with this new machine. He looks ahead to the time when all new houses can have fireproof and maintenance free roofs of concrete tile, and when those houses now built, but with roofs which deteriorate, have reroofed for the last time, with concrete shingles.

Legislation, such as has been in effect in European countries for many years requiring permanent, firesafe roofs, will not be necessary to provide American home owners with these safer, better roofs. The ingenuity and perseverance of this pioneer manufacturer brings it to this country in a way that laws could never do.



The shingles, and buildings "roofed to last"

Housing Is Not Overbuilt

"IT IS RIDICULOUS to suppose that housing is overbuilt, for the facts are to the contrary," Ernest Grunsfeld, architect, said recently in discussing the housing bill which is being advocated to Illinois legislators. "Our problem is to build better homes and to keep the cost down," he said. Several amendments have been made to the original bill, which did not pass the last session of the legislature. Similar laws have recently been passed in Texas and Ohio, and New York has had such a law for several years.

Graham Brothers, Inc., Aggregate Producers, Expanding Activities

GRAHAM BROTHERS, INC., Long Beach, Calif., are constructing one of the most novel concrete products plants in existence. The plant is not to be confused with the conventional one in which tile, block, etc., are constructed; for in this case the plant's only output will be a concrete caisson for under-water construction purposes.

Graham Brothers, Inc., secured the contract for construction of concrete caissons that will be used to build a yacht harbor at Santa Monica, Calif. The caissons will be poured at the mixing plant at Long Beach and will be floated out through Long Beach's new harbor to Santa Monica, where they will be sunk into place. The total job involves roughly 25,000 cu. yd. of concrete and will be mixed by the Transit system.

To construct these caissons a "Graving Dock" is being constructed. This is a dock that resembles a lock on a canal and the floor of the dock will be on a level with the bottom in Long Beach harbor. Special forms will be placed in the graving dock and the caissons poured, after which the lock gates will be opened and flooded and the concrete caisson floated to destination. The Puget Sound Bridge and Dredge Co. has the contract for constructing the graving dock, a portion of which is shown in the accompanying illustration.

Concrete caisson plant of Graham Brothers, Inc.

Buy Kansas City, Mo., Plant of the Haydite Co.

OF MUCH INTEREST to the concrete products industry in the Kansas City district is the sale by the receiver of the Kansas City, Mo., Haydite Co. on October 3 to the Haydite Corp., newly organized. Officers of the Haydite Corp. are Dan F. Servey, president and treasurer, and H. H. Schmitt, secretary. It is understood that the Pittsburgh, Penn., plant will be sold by the receivers in the near future.

The Kansas City plant includes not only the plant to produce Haydite aggregate, but includes a block manufacturing department equipped for large capacity. The Haydite department is equipped with one 6- by 50-ft. kiln in which oil is used for fuel. This plant was started up October 16.

It was in Kansas City that the pioneer work on Haydite was carried out. The first Haydite block was made there, and much structural work has been done with Haydite aggregate. Mr. Servey has played an active part both in the early fight for recognition of the material and in increasing its acceptance. He has been in charge of the Kansas City operation for the past 10 years. The large number of buildings in which Haydite has been used there is evidence of his success in this promotion.

The policy of the newly formed Haydite Corp. will be to maintain a price for Haydite that will make it more competitive with natural aggregates, Mr. Servey states.

Lime Used in Reinforced Brick Masonry Mortar

LIME MANUFACTURERS in particular should be interested in the progress of the development of reinforced brick masonry now being hailed by the brick industry as a solution to its difficulties. For this type of construction, a mortar of ½ part lime putty, 1 part portland cement and 3¾ parts of clean, sharp torpedo sand was used on a series of tests recently conducted in Chicago. Wisconsin high magnesia lime was used, though the report does not state that high calcium lime would not be equally satisfactory.

A great deal of experimentation has been carried out and a number of tests conducted on this type of construction. Both manufacturers of common and face brick are being exhorted to support and promote the use of this type of construction.

It is difficult to see how it will ever be made practical for any volume of construction, but it is novel to many and this may win a certain amount of business. Since brick manufacturers are spending a great deal of time and money to obtain its acceptance, lime manufacturers may find some new business by following this development in their territories.

Tolerances Included in Specifications for Cement

MINOR editorial changes, to include tolerances for limits of chemical properties, have been made in the text of American Standard Specifications for portland cement (Aia-1931) (A.S.T.M. C 9-30). As originally issued, limits for chemical properties appeared in Section 2 of the Standard Specifications; and tolerances for these limits were given in the Standard Methods of Testing Portland Cement (Aib-1931) (A.S.T.M. C 77-30).

A revision of the Standard Methods of Testing Portland Cement is now being considered by the sectional committee, following its adoption by the American Society for Testing Materials, sponsor for the project. In connection with this revision, tolerances for the chemical limits have been transferred to the standard specifications and now appear in Section 2 as follows:

	Limits	Tolerance
Loss on ignition, per cent	4.00	0.25
Insoluble residue, per cent	0.85	0.15
Sulfuric anhydride (SO_3), per cent	2.00	0.10
Magnesia (MgO), per cent	5.00	0.40

Phosphates in Tennessee

INCREASED shipments of phosphate from the Tennessee field have been noted in recent weeks, three of the large companies now being in regular, though curtailed, operration, and some hand miners are at work. About 30 cars per day are being shipped.

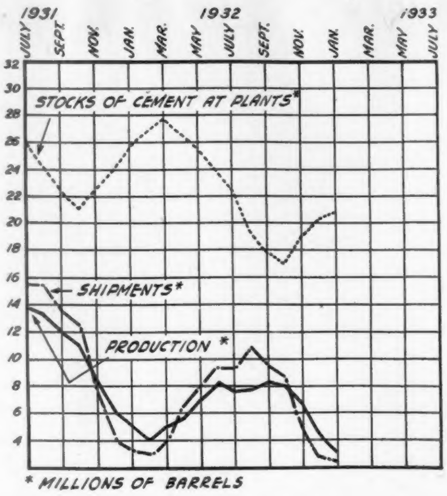
Portland Cement Production

THE PORTLAND cement industry in January, 1933, produced 2,958,000 bbl., shipped 2,502,000 bbl. from the mills, and had in stock at the end of the month 20,660,000 bbl. Production of portland cement in January, 1933, showed a decrease of 41.1% and shipments a decrease of 26.3%, as compared with January, 1932. Portland cement stocks at mills were 19.9% lower than a year ago.

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during November and December, 1931, and 1932, in barrels:

Shipped to	Nov., 1932	1931—December	—1932
Alabama	46,722	21,963	33,085
Alaska	528	25	82
Arizona	11,747	15,640	4,284
Arkansas	24,462	17,112	16,576
California	368,806	322,270	312,268
Colorado	30,044	22,047	12,797
Connecticut	55,588	51,564	29,343
Delaware	28,807	11,461	15,419
District of Columbia	88,796	77,875	71,333
Florida	31,192	33,081	46,992
Georgia	96,639	83,222	64,203
Hawaii	14,050	12,473	12,400
Idaho	6,095	3,286	1,027
Illinois	272,348	193,244	99,279
Indiana	76,993	72,495	40,604
Iowa	86,539	34,916	30,487
Kansas	79,749	86,455	39,204
Kentucky	85,261	49,417	41,032
Louisiana	108,552	77,914	64,856
Maine	15,169	11,145	12,522
Maryland	101,789	133,256	75,581
Massachusetts	132,313	110,738	85,020
Michigan	94,471	119,925	36,172
Minnesota	35,044	35,166	24,515
Mississippi	42,922	5,820	29,850
Missouri	153,983	178,052	89,832
Montana	5,997	3,697	4,228
Nebraska	49,924	25,655	12,092
Nevada	61,177	12,587	27,500
New Hampshire	26,044	9,272	4,655
New Jersey	178,586	212,095	119,347
New Mexico	12,752	9,934	7,803
New York	623,446	760,928	404,367
North Carolina	30,813	35,452	32,994
North Dakota	3,590	1,258	2,116
Ohio	248,100	194,959	144,416
Oklahoma	119,817	121,420	52,963
Oregon	19,121	16,332	12,151
Pennsylvania	376,978	298,610	239,051
Porto Rico	6,850	8,525	8,750
Rhode Island	19,367	26,601	13,145
South Carolina	10,783	52,483	15,994
South Dakota	6,325	8,749	4,133
Tennessee	111,559	44,322	59,147
Texas	363,185	223,504	168,989
Utah	20,118	6,861	5,729
Vermont	7,026	5,602	3,434
Virginia	57,857	78,200	55,574
Washington	45,327	50,654	20,126
West Virginia	43,485	50,176	49,690
Wisconsin	87,968	73,102	35,346
Wyoming	6,011	2,661	3,219
Unspecified	101,193	....	11,851
Foreign countries	49,992	27,799	27,427
Total shipped from cement plants	4,782,000	4,142,000	2,835,000



Portland Cement Production, January

The statistics here given are compiled from reports for January, received by the Bureau of Mines, from all manufacturing plants except three, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants both at the close of January, 1933, and of January, 1932.

RATIO (PER CENT) OF PRODUCTION TO CAPACITY

	January 1932 Pct.	January 1933 Pct.	Dec. 1932 Pct.	Nov. 1932 Pct.	Oct. 1932 Pct.
The month	22.0	12.9	18.5	29.1	34.6
12 months ended	45.9	27.6	28.3	29.0	29.6

Appointed Manager

MARK BEEMAN has been appointed manager of the Washington office of the Portland Cement Association, assuming his new work February 1. He succeeds A. C. Toner, who has been granted an indefinite leave of absence due to ill health.

For 10 years before the war Mr. Beeman was in Chamber of Commerce work in Cleveland, Buffalo and the New Jersey state Chamber of Commerce. During the war he was assistant director of film propaganda.

Following the war, Mr. Beeman located in London as European sales manager for an American film company. With the organization of the Concrete Reinforcing Steel Institute, eight years ago, Mr. Beeman became its secretary.

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1931 AND 1932

Month	1931—Exports Barrels	Value	1932 Barrels	Value	1931—Imports Barrels	Value	1932 Barrels	Value
January	41,199	$115,678	36,704	$82,984	95,609	$120,298	14,375	$16,648
February	25,703	88,989	12,889	39,350	21,984	25,391	83,707	69,197
March	54,599	144,579	39,105	81,856	70,378	80,360	19,173	17,215
April	40,478	116,564	30,123	69,451	53,333	58,576	59,392	40,999
May	48,028	140,953	31,634	71,048	19,325	20,568	9,223	7,358
June	43,597	107,610	33,134	72,084	32,079	42,955	19,962	14,715
July	29,344	97,837	18,972	54,814	14,332	15,582	31,519	24,904
August	39,517	106,643	25,110	48,961	8,895	11,739	76,407	55,710
September	27,570	81,399	35,270	63,018	33,574	33,520	68,220	49,754
October	24,531	68,524	28,756	52,922	39,642	42,380	59,769	40,380
November	33,200	97,796	57,811	98,187	27,940	22,235	11,692	7,414
December	21,887	54,028	25,073	67,530	40,147	34,314	9,057	6,739
	429,653	$1,220,600	374,581	$802,205	457,238	$507,918	462,496	$351,033

Sand-Lime Brick Production and Shipments in January

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick located in various parts of the United States and Canada. The accompanying statistics may be regarded as representative of the industry.

Twelve sand-lime brick plants reported for the month of January, this number being two less than the number reporting for the month of December, statistics for which were published January 25.

Average Prices for January

Shipping point	Plant price	Delivered
Dayton, Ohio	$ 9.00	$10.00
Detroit, Mich.	9.00	10.00-11.50
Flint, Mich.	11.50	13.00
Grand Rapids, Mich.	....	12.50
Milwaukee, Wis.	7.50	10.50
Minneapolis, Minn.	....	7.50
Saginaw, Mich.	9.50	....
Syracuse, N. Y.	18.00	20.00
Toronto, Ont., Can.	12.00	13.50

Statistics for December and January

	*December	†January
Production	797,500	605,540
Shipments (rail)	82,000	110,000
Shipments (truck)	883,725	1,233,254
Stocks on hand	4,792,426	4,621,930
Unfilled orders	5,755,000	7,325,000

*Fourteen plants reporting; incomplete, three not reporting unfilled orders.

†Twelve plants reporting; incomplete, three not reporting unfilled orders.

Concrete Paving Yardage

CONCRETE paving yardage as awarded in the United States during January, 1933, and January, 1932, are reported by the Portland Cement Association as follows:

	Yardage awarded during January, 1933	Yardage awarded during January, 1932
Roads	5,129,062	2,252,048
Streets	256,108	234,134
Alleys	1,700	33,031
Total	5,386,870	2,524,213

Ireland to Permit Free Import of Cement Clinker

THE Cement (Customs Duty Undertaking) Bill, a measure sponsored by the Irish government, provides for the importation into the Irish Free State of cement clinker free of duty for at least ten years. The object is to provide any company undertaking the establishment of a grinding mill in the Free State assurance of its supply of raw material for at least that period. According to the Minister for Industry and Commerce, one company is prepared, as soon as the bill is passed, to provide the necessary capital and to proceed at once with the erection of grinding mills. He stated that in six or nine months cement from this source would be available which would be up to the current British standard specification, and would be sold at prices below those now prevailing. It is anticipated that the bill will be passed with very little opposition.

Recent Prices Bid and Contracts Awarded

Lansing, Mich. Eight bids for furnishing the state 26,300 bbl. of cement were recently rejected by the secretary of the administration board because bids were identical. For 2500 bbl. at Hart the bid was $2.17 per bbl. For 23,800 bbl. near Port Huron the bid was $1.92.

Chicago, Ill. Because there were only three bidders for city cement requirements, which were 56% higher than last year, Mayor Cermak recently rejected all bids. Bids on 150,000 bbl. were $2.45, delivered by truck; $2.10 delivered by rail, and $2 delivered in bulk.

St. Louis, Mo. Prices of building materials have advanced stiffly here, a survey shows. In lump sums, prices have advanced as follows: Sand, in car lots, 15c. per ton; gravel, in car lots, 10-15c. per ton; cement, in car lots, 10c. per bbl., and ready mixed concrete, 50 to 75c. per cu. yd.

Mt. Vernon, Ind. Posey county commissioners have awarded contracts to the Koch Sand and Gravel Co., Evansville, Ind., delivered at the points listed, at prices per cu. yd. as shown: Mt. Vernon, 95c.; Poseyville, $1.93; Wendel Station, $1.93, and St. Phillips, $1.79.

Fostoria, Ohio. Three firms have submitted bids ranging from 50 to 90c. a ton. The Higgins Stone Co., Bellaire, Ohio, bid 80c. per ton for all sizes except No. 6, which was at 90c. Basic Dolomite, Inc., bid 80c. on all grades except No. 7, which was at 50c. France Stone Co. bid 80c. on all sizes except No. 9, which was at 90c.

Seattle, Wash. Salmon Bay Sand and Gravel Co. has been awarded city contract for 175 cu. yd. of ballast at $1.75.

Wapakoneta, Ohio. Three Auglaize firms are expected to receive contracts on an award of 5000 tons of crushed stone by county commissioners. The bids averaged $1.06 per ton against $2.21 in 1925.

Columbus Junction, Ia. Louisa county is offering agricultural limestone at 25c. per ton at the quarry.

Geneva, Ind. Adams county commissioners have awarded contract for crushed stone and sand on the basis of 80c. per ton for screened and sized stone, and 50c. per ton for screenings. The delivery price on the roads ranged from $1.20 to $1.35 per ton. For rail delivery the price was 10 to 15c. per ton lower than the delivered price.

Stephan Stepanian Elected President

STEPHAN STEPANIAN, secretary, Arrow Sand and Gravel Co., Columbus, Ohio, was elected president of the Ohio Sand and Gravel Producers Association at its meeting February 4. He succeeds J. J. Gordon, president of the Zanesville Washed Gravel Co. The latter was named a member of the executive committee.

Other officers elected were: A. E. Frosch, Eastern Ohio Sand and Gravel Co., East Liverpool, vice-president; J. D. Evans, Sturm and Dillard, Circleville, secretary and treasurer.

Other members of the executive committee are: C. E. Glander, Greenville; American Aggregates Corp.; H. J. Knight, Rubber City Sand and Gravel Co., and E. W. Trettschuh, Ohio Gravel Co.

State Highway Director Merrill was principal speaker at the meeting.

Trinity Announces Changes in Officials

THE Trinity Portland Cement Co., Dallas, Tex., announces the election of Raymond T. Gunderson and R. N. Cowham as directors to fill vacancies caused by resignations of Frank G. Ray and the late W. H. L. McCourtie, both from the board and as secretary and president, respectively. An executive committee of the board, consisting of R. T. Gunderson, John L. Senior and C. E. Ulrickson, was elected. John L. Senior was elected president and Raymond T. Gunderson secretary.

Look for Higher Cement Prices

CEMENT manufacturers are refusing to quote prices to the city of Rochester for delivery after March 1, various press reports state. The city failed to obtain a single bid for 5000 bbl. to cover its needs. Cement manufacturers told the city they expected better prices after March 1.

As a result the city did not award the bid. City Purchasing Agent Norton said in all probability the city would buy cement by the month.

Appoints Bert S. Keller Sales Manager

THE Riverside Lime and Stone Co., Chicago, Ill., announces that Bert S. Keller, formerly with Dolese and Shepard Co., is

Bert S. Keller

now associated with it as sales manager. Mr. Keller's headquarters will be at the company sales office in the Conway building.

RETAIL MATERIAL PRICES, DELIVERED, JANUARY 1, 1933 (COMPILED BY DEPARTMENT OF COMMERCE)

City	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.65	....	$26.79	$1.25	$2.00	....
New London, Conn.	2.40	$25.00	$18.00	1.00	2.00	$18.00
Haverhill, Mass.	2.60	25.00	16.00	......	......	17.00
New Bedford, Mass.	2.60	25.00	16.50	1.25	2.50	16.50
Albany, N. Y.	......	23.85	15.75	......	......	16.20
Buffalo, N. Y.	2.95	21.00	18.00	2.50	2.05	16.00
Poughkeepsie, N. Y.	2.50	35.00	18.00	2.25	2.00	13.00
Rochester, N. Y.	2.47	22.00	14.50	2.00	2.40	16.00
Syracuse, N. Y.	2.60	20.00	....	1.80	1.50	14.00
Paterson, N. J.	2.20	24.00	18.00	1.50	2.10	17.50
Trenton, N. J.	2.20	28.00	14.50	1.50	2.10	15.50
Philadelphia, Penn.	2.24	....	12.50	1.65	2.40	15.00
Scranton, Penn.	2.40	30.00	18.00	3.38	......	18.00
Baltimore, Md.	2.10	25.00	13.00	1.85	2.50	15.50
Washington, D. C.	2.20	25.00	14.00	......	......	16.00
Fairmont, W. Va.	2.40	35.00	16.00	2.60	3.50	18.00
Atlanta, Ga.	2.50	36.00	12.50	3.00	2.50	17.00
Tampa, Fla.	2.60	50.00	....	2.00	2.80	20.00
Shreveport, La.	3.20	40.00	....	1.75	2.60	20.00
Columbia, S. C.	2.60	40.00	13.50	1.38	2.50	12.00
New Orleans, La.	2.65	41.75	14.00	2.75	......	18.00
Akron, Ohio	$1.81	$40.00	$14.00	$1.50	$2.50	$15.50
Cleveland, Ohio	2.60	....	12.00	1.28	2.20	18.00
Columbus, Ohio	2.00	....	14.00	1.22	......	16.00
Toledo, Ohio	1.92	20.00	12.00	1.75	2.25	14.00
Lansing, Mich.	2.25	....	20.00	1.90	......	17.50
Saginaw, Mich.	1.98	22.00	16.00	2.00	2.20	16.50
Terre Haute, Ind.	2.20	28.00	18.00	1.25	3.00	18.00
Louisville, Ky.	2.32	....	15.00	1.32	1.90	17.00
Milwaukee, Wis.	2.00	22.00	14.00	1.25	1.25	15.20
Des Moines, Iowa	1.82	....	....	......	......	14.00
Kansas City, Mo.	2.20	25.00	22.00	1.82	2.00	17.00
St. Paul, Minn.	2.10	30.00	21.00	1.00	1.60	17.00
Grand Forks, N. D.	3.00	23.00	19.00	1.25	1.75	17.00
Sioux Falls, S. D.	2.00	22.00	20.00	1.25	1.75	15.50
Denver, Colo.	2.80	40.00	....	......	......	15.00
San Antonio, Tex.	2.40	39.00	17.50	2.00	2.25	18.15
Tucson, Ariz.	3.29	40.00	30.00	1.25	2.25	17.10
Los Angeles, Calif.	2.30	21.00	24.70	1.20	1.30	16.15
San Francisco, Calif.	2.60	45.00	22.50	1.40	1.60	17.30
Seattle, Wash.	2.70	....	....	1.75	......	....

Modern Ways of Fighting Abrasion

By George Sykes
Haynes Stellite Co., New York City

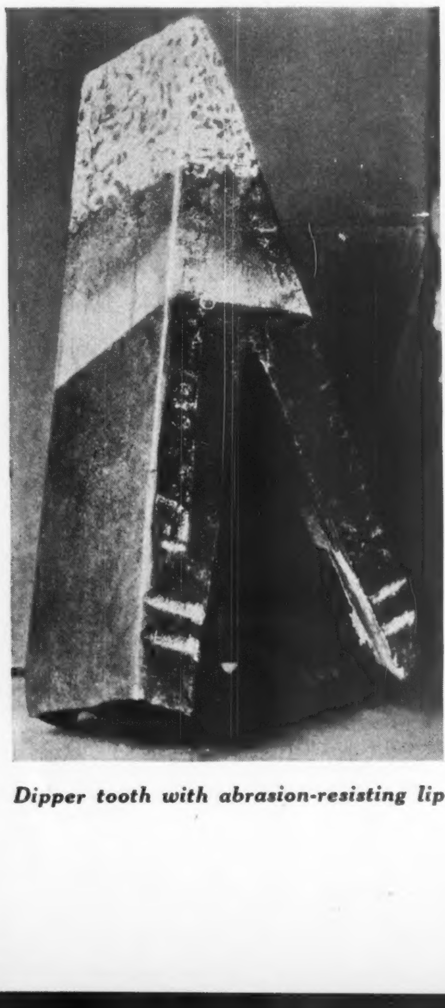
IN THE rock products industry all equipment is subjected to terrific abrasion. Whether it be drill bits, shovel teeth, bucket lips, dredge cutters, chain links or crushers—the life of these and other parts is measured in weeks or days and even in hours.

Modern methods require that the life of abrasion-resisting parts be in keeping with modern production efficiency. To this end, those wearing surfaces which ordinarily are rapidly worn always are hard-faced.

Hard-facing consists of applying by the oxy-acetylene or electric arc process a layer of hard, abrasion-resisting alloy to the surface to be protected. The procedure is easy and this method offers an economical means for greatly prolonging the life of equipment. The following examples, taken from numerous applications in the mining and excavating fields, will serve to illustrate the savings effected by this method of reducing wear.

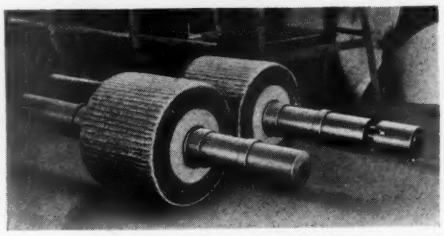
At a large cement quarry in Michigan the life of dipper teeth has been increased from 1 month to 6 months by the application of hard-facing material to the wearing tips. The teeth of a 12½-yd. shovel used for stripping in an Indiana quarry were hard-faced before being put into service and lasted seven times as long as an ordinary set.

The lips of clamshell buckets and dragline buckets have been economically hard-faced. A clamshell bucket used for unloading coal, sand and gravel at a Detroit plant when hard-faced showed an increased life ratio of 5 to 1. The hard-faced lips of another bucket wore only 1/16-in. in 15 months of continual service, whereas prior to hard-facing the lips wore at the rate of ¾-in. for the same period. The life of pins and links on dragline buckets has been increased materially by the application of hard-facing material to their wearing surfaces.



Dipper tooth with abrasion-resisting lip

In the foregoing examples Haynes "Stellite," an extremely hard and abrasion-resisting alloy of cobalt, chromium and tungsten, was used. Where equipment is subject to heavy shock in addition to severe wear, the life ratio has been materially increased in many instances by the application of "Hascrome," a self-hardening alloy that combines strength and toughness with considerable hardness. This alloy has been used to advantage in hard-facing all types of crushing and grinding equipment. One gyratory crusher mantle, hard-faced with "Hascrome," showed a gain in life ratio of 2 to 1 at a cost only one-sixth that of a new mantle.



Crushing rolls resurfaced

Recently "Hascrome" has been introduced for excavating work in the form of cast tips to be welded on the ends of worn dipper teeth. A worn tooth is trimmed with a cutting torch to the correct length to allow for the addition of the "Hascrome" tip and beveled to form a Vee with the new tip. With the new tip in position, both Vees are filled electrically with high carbon steel welding rod.

When parts to be hard-faced are badly worn, they are often first built up with "Hascrome" to almost the desired size and then finished off with a layer of "Stellite." Each alloy has been developed for special use.

Besides these parts where abrasion is due to the action of rock, sand or gravel, there are many metal-to-metal wearing surfaces that are economically hard-faced to give longer life. Modern plants have found that the application of an abrasion-resisting alloy to bushings, bearings, shafts, sprockets and other wearing parts results in the increased life of these parts with large savings.

Both "Stellite" and "Hascrome," in the form of welding rod, are readily and economically applied to surfaces which are rapidly worn away and have proved to be the modern answer to countless problems involving severe abrasion.

Symposium on Particle Size Measurements

A SYMPOSIUM on particle size measurements at which representatives from each of several industrial groups will discuss the meaning of particle size and the methods of measurement in use with their respective industries will be held in New York in connection with the New York Regional Meeting of the American Society for Testing Materials on March 8. The following subjects will be included:

Abrasives—Henry Power, director, chemical laboratory, Carborundum Co.; Dusts—Prof. Phillip Drinker, School of Public Health, Harvard University; Coal—R. M. Hardgrove, Fuller-Lehigh Co.; Cement—J. C. Pearson, director of research, Lehigh Portland Cement Co., and J. R. Dwyer, research associate, Bureau of Standards; Road and Concrete Aggregates—Stanton Walker, director, engineering and research division, National Sand and Gravel Association; New Developments in Sieves and Testing—A. A. Klein, petrographer, Norton Co., and Proposed American Standard for Sieves—L. V. Judson, physicist, Bureau of Standards.

In the afternoon there will be an open meeting of A.S.A. Committee Z-23 to be held for consideration of the proposed standard for sieves. This will be followed by a meeting of A. S. T. M. Committee E-1, III for discussion of methods of particle size measurement which are open for standardization.

Installs Unique Classifying Equipment

AN interesting sand cleaning system is being installed by T. L. Herbert and Sons, Nashville, Tenn., at its sand and gravel plant. This will include two specially constructed Deister-Overstrom diagonal deck concentrating tables which will separate out two products, masonry sand and concrete sand.

While such tables are used quite generally in coal washing plants, foundries and mines, it is said that this will be the only commercial sand plant in the country using concentrating tables. The addition to the plant was designed by the company and the steel will be furnished by the Nashville Bridge Co. The conveyors and dewatering drag will be Link-Belt type. Work on it is expected to be completed in March.

Elect R. J. Stewart President

AT the annual meeting of the stockholders of the Pioneer Sand Co., St. Joseph, Mo., Captain R. J. Stewart was elected president to succeed the late Bernard Feeney, Sr. Other officers elected were A. L. Lehr, vice-president, I. A. Vant, treasurer, and C. J. Feeney, secretary. M. O. Land was the only new director elected.

Detachable Bits for Air Drills

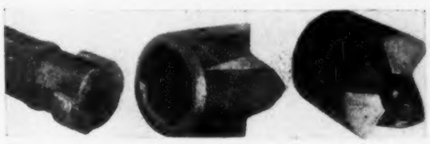
VARIOUS detachable bits for use with air drills are described in the November issue of *Engineering and Mining Journal.* These include the Hawkesworth bit, made by the Hawkesworth Drill Co., Butte, Mont.; the Thurston bit, made by the Detachable Bit Corp. of America, New York; the Erbit, made by the Economy Rock Bit Corp., Lancaster, Penn.; the Timken bit, made by the Timken Roller Bearing Co., Canton, Ohio;

Hawkesworth bit with dovetailed joint

the DeWitt bit, made by the DeWitt Detachable Bit Co., Oakland, Calif.; the Crusca bit, made by the Crucible Steel Co. of America, New York; the Rip-Bit, made by George C. Riley, Montreal, Can., and the Granby bit of the Granby Consolidated Mining Co. of Canada.

Thurston bit with coupling

Some of the advantages claimed for such bits are: longer life, greater drilling speed, less investment in steels, less sharpening equipment and a saving in resharpening and handling. It is stated that with ordinary drill steels in mining work the sharpeners use 5 to 12% of the total air and that the cost of sharpening is up to 10 c. each.



DeWitt bit with bayonet lock

Detachable bits are made in sizes ranging from 1⅜-in. to 3¼-in. gage and are of manganese, special alloy or high carbon tool steel. They can for the most part be resharpened and used a number of times.

Several methods of attaching the bits to the rods are shown in the accompanying

Crusca bit with left-hand threads

illustrations. The Hawkesworth bit is attached to the rod by a modified dovetailed joint; the Thurston bit by a left-hand threaded coupling; the DeWitt bit by a bayonet lock which is locked by a quarter turn and kept locked by the rotation of the rod; the Granby bit by a tapered pin, and the others by left-hand threads.

Sells Utah-Idaho Portland Cement Co.

OFFERING $148,555.15 for the property and assets of the Utah-Idaho Portland Cement Co., Ogden, Utah, the Western Portland Cement Co., which has just filed articles of incorporation, was the only bidder at the public auction held in Ogden recently. The sale was conducted by an attorney for the receivers for the company.

The Utah-Idaho Portland Cement Co. property consisted largely of a plant at Brigham City, Utah, and its equipment, and about 2000 acres of land near Pocatello, Ida. The bid included $10,000 for real estate in Utah, $136,355.15 for buildings, improvements and machinery; $200 for inventories and products, $1000 for accounts receivable and $1000 for the Idaho property.

The sale of the Idaho property was protested by a Pocatello attorney who claimed that this property belonged to a client of his and that anyone buying it would do so subject to her claim. The Western Portland Cement Co., which purchased the property, was formed recently and represents the bondholders of the Utah-Idaho Cement Co., consisting of a number of banks in Ogden and Salt Lake City. These banks hold a total of $147,555.15 of bonds in the company.

Talc Deposit to Be Developed

THE Gerhardt Talc Corp., with authorized capital stock of $100,000, has been chartered to develop a talc deposit near Staley, N. C., which is said to be of excellent quality. A large part of the deposit is above ground level.

A separating and crushing plant will be installed right away and only the finished product will be shipped. The incorporators are Paul Gerhardt, and his brother H. C. Gerhardt, of Tucson, Ariz., life-long miners, W. R. Clegg, attorney of Carthage, and Bruce Craven, of Trinity, N. C. Most of the stock is owned by the Gerhardt brothers.

German Gypsum Association Announces Changes

THE German Gypsum Association announces that Fritz Eisemann has been made its director. The association is now located at Berlin-Charlottenburg 9, Lindenallee 18. It also announces that the former Building Service Bureau of the German gypsum industry is now merged with the German Gypsum Association.

Oppose Plea for Reduced Fluorspar Tariff

DECLARING that the productive capacity of domestic fluorspar producers is ample to supply United States requirements, a committee representing Illinois and Kentucky producers testified before the Tariff Commission December 8 in opposition to demands for lower duties.

R. C. Allen, representing sales agents for fluorspar producers, told the Commission that new processes have enabled domestic producers to increase their output and make the United States self-sufficient with regard to its fluorspar needs.

Recent reductions in shipments from domestic producers, he said, have been due to economic conditions, stocks on hand and imports. He asserted that if the mines in Illinois and Kentucky continue to shut down there will be no acid grade spar for industrial requirements. These mines could continue if the domestic product were more widey used, he said.

He testified that certain waste material made available through the use of a flotation process will have future possibilities in producing the concentrate.

Seven Quarry Workers Killed

AN AVALANCHE of rock, estimated at 100,000 tons suddenly gave way and buried seven men at the quarry of the B. and C. Lime and Stone Co. at Fletcher, near Asheville, N. C., on February 8. The slide was said to have resulted from recent heavy rains which had watersoaked the soil and caused an overhanging shelf of rock to fall, carrying down other rock and dirt with it. The quarry at this point was about 125 ft. deep. Because there was no warning, none of the workers at that point escaped death.

Erratum

THE EDITOR regrets that his script of the article on "New Products and New Uses for Rock Products Plants," page 52, December 31, 1932, issue, led the compositor to change "National" to "Material," and that the error slipped by the proofreaders. Our good friend M. H. Baker, who supplied much of the information on the new weather-proof gypsum board, used on some of The Century of Progress Exposition buildings, Chicago, Ill., is president of the National Gypsum Co., Buffalo, N. Y., as we trust most of our readers know.

Duke F. Stewart

DUKE F. STEWART, former president of the Stewart-Peck Sand Co. and its successor, the Stewart Sand and Material Co., died recently of a heart attack at his home in Kansas City, Mo.

New Machinery and Equipment

Diaphragm Jig for Gravel

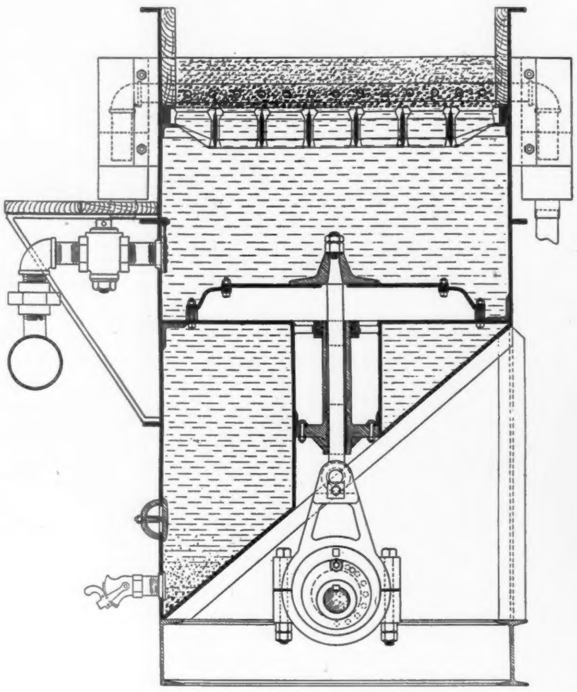
AN improved jig which makes use of diaphragms instead of plungers and which is said to successfully remove shale, lignite, etc., from gravel has been developed by F. N. Bendelari, Joplin, Mo. Unusual efficiency is claimed because of uniform water action over the whole bed and the provisions for settling the fine material in the hutches. Stratification is said to be rapid and the material may be drawn from either side.

The jig is constructed of electric-welded steel plate. The lineshaft and eccentrics are below and a tube through each hutch permits connecting the eccentric to the diaphragm by means of a pin and crosshead. The weight of the diaphragm head is carried on the eccentric so that the rubber diaphragm acts only as a seal.

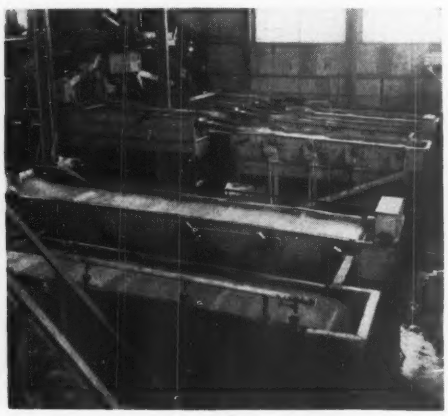
The screen frame may be lifted out without damaging the cloth and streamlined webs touch the cloth only at intersections where the cloths are fastened. The diaphragm forces water up through the screen and on the downward stroke pulls the small material through the screen into the hutch. Coarse gravel is drawn from above the screen and fine material passes through holes at the corners of the diaphragm plates and is drawn from the hutch below. Waste water passes over the top of the cells to a tailings spout.

The action of the diaphragm is said to produce a positive pressure evenly over the whole material bed which is lifted with slight pulsation. Water is admitted below the screens through check valves on the down stroke of each diaphragm. The amount of water so admitted is regulated by control valves and the action of each cell may thus be changed while the jig is running.

It is stated that the 42-in. 3-cell gravel jig which weighs 9600 lb., uses 250 gallons of water per minute, and requires 7½-hp., has, in an Iowa installation, given very satisfactory results in removal of shale and soft stone. This machine was handling ¼ to 1-in. gravel. The jig is not recommended for material larger than 1-in.



Cross-section of diaphragm jig



Battery of diaphragm jigs

Rubber Guide Bearings

THE B. F. Goodrich Rubber Co., Akron, Ohio, manufactures cutless rubber bearings for use with water lubrication. These bearings have been used extensively in hydraulic turbines, and have certain advantages over oil-lubricated metal bearings in some work. They have shown high resistance to abrasion and will support heavy shafts under difficult operating conditions.

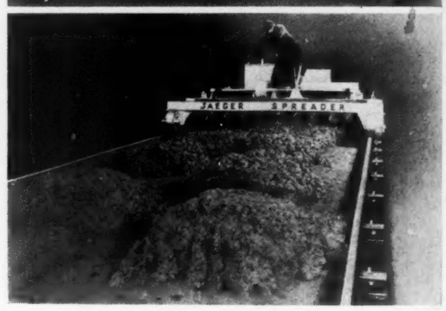
Makes Stoker

THE Patterson Foundry and Machine Co., East Liverpool, Ohio, announces that it is now manufacturing a full line of stokers, both for domestic and industrial use.

Paving Equipment for Ready Mixed Concrete Placement

THE USE of ready mixed concrete for pavement construction is not generally practiced at present, but has aroused much interest throughout the country and is expected to develop into an important volume. To make such placement more economical special equipment has been developed. Two such developments are announced by the Jaeger Machine Co., Columbus, Ohio.

The first of these, the Jaeger transfer plant, is for transfer of proportioned concrete batches from batch trucks to truck mixers, thus keeping truck mixer investment low. It is estimated that the economical truck mixer haul on such work should not exceed approximately 1½ mi. beyond the transfer plant. A set-up of the plant, requiring about 1 yd. of excavation, is thus required about every second day. Plants are made to care for mixers of from 1½ to 4 cu. yd. in size.

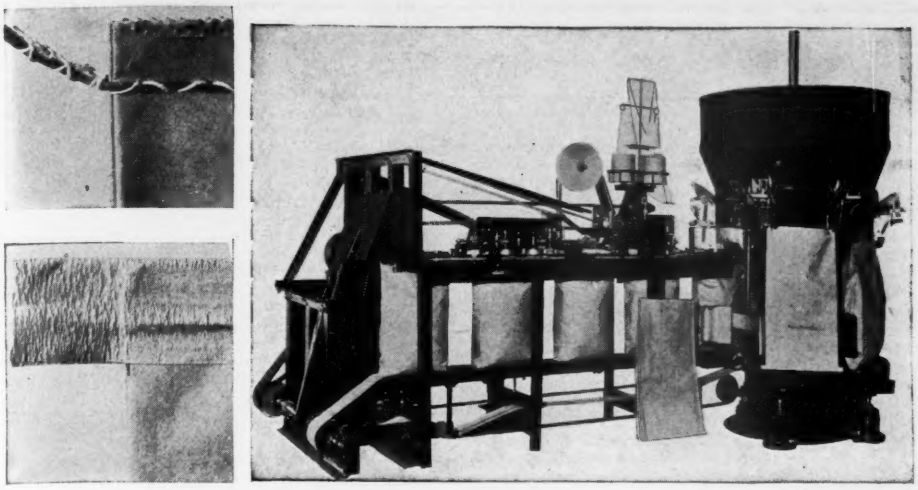


Above, transfer plant; below, mechanical spreader

A second development is the Jaeger mechanical spreader, to which a side discharge truck mixer unit discharges directly to the spiral conveyor, which distributes the concrete across the road. The hopper can be set on either side of the spreader, and the spiral itself is reversible in operation. No belt feeder is required. This spreader may be used with end-discharge mixers if the consistency permits placing concrete within the form line in a longitudinal windrow.

Bagging Equipment

A NEW DEVELOPMENT in equipment which decreases the limitations on types of materials which may be economi-



At left, above, kraft cord showing cushion stitch; below, end of bag with tape applied; at right, complete automatic bag packer

cally bagged is announced by Bagpak, Inc., New York, N. Y. This equipment automatically weighs, fills, closes and seals open mouth bags at high speed, the manufacturer states.

The "Bagpaker" is made in four types; a machine for automatically weighing, filling and closing bags; a machine for automatically closing bags that have been filled on other equipment; a hand-fed machine for filling and closing; and a hand-fed machine for closing only. The machines are designed to be adjustable for materials of varying bulk. In this way one machine may be used for a number of products in a plant.

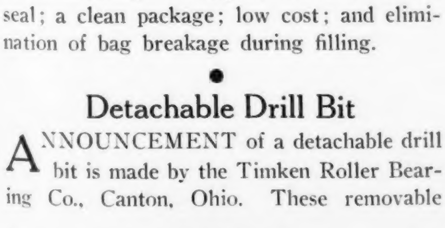
In operation, the completely automatic machine has two automatic scales which feed into hoppers mounted on a revolving turret. Bags placed on spouts of the revolving turret are filled while it revolves. While filling, the bag is joggled. When filled the bag is automatically removed and passes through a sewing unit, and thereafter through a tape applicator, giving a double seal.

Capacities vary with type of material to be packed. One machine, the *A*, equipped with two filling scales, will fill at the rate of fifteen 100-lb. bags per minute. Advantages claimed for these machines are extreme accuracy in weight; will not leak at seal; a clean package; low cost; and elimination of bag breakage during filling.

Detachable Drill Bit

ANNOUNCEMENT of a detachable drill bit is made by the Timken Roller Bearing Co., Canton, Ohio. These removable bits have left-hand thread (opposed to direction of rotation of steel). Drilling force is transmitted through an upset shoulder to the body of the bit, so that no strain is imposed on the threads, the manufacturer states.

Bits are of high carbon steel made in an electric furnace and, it is claimed, will drill farther before becoming dull than conventional upset bits. These bits are claimed to be more economical than conventional bits that are resharpened.



Detachable drill bit

To Furnish Ocala Crusher Parts

THE McLanahan and Stone Corp., Hollidaysburg, Penn., announces that it has purchased patterns, drawings and records of the Ocala Iron Works, Ocala, Fla., which plant has been closed and dismantled. Repairs to Ocala crushers, dryers and other equipment, also new units of that design, may now be obtained from the McLanahan and Stone Corp.

Belt Conveyors

A HANDBOOK for designers who employ belt conveyors, or who have material handling problems, has been published by the Robins Conveying Belt Co., New York, N. Y. The book contains comprehensive charts and tables. Many types of belt conveyor installations are illustrated and discussed. There are more than 20 pages of technical data and information, in addition to 70 pages of general information.

Jaw Crusher

AN IMPROVEMENT to its crusher is announced by the Good Roads Machinery Corp., Kennett Square, Penn. This consists of an adjustable feed opening to accommodate either primary or secondary crushing. The crusher is equipped with roller bearings.

The 10x30 in. size can be adjusted to give an opening of 15x30 in. for primary crushing and the 10x40 in. size can be adjusted to give a 15x40 in. opening.

To Handle Cement Mill Business

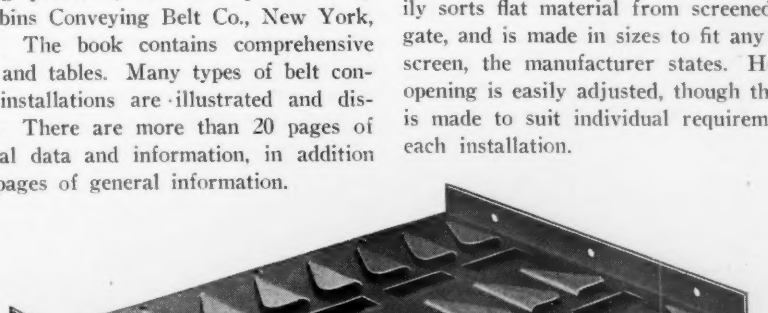
CREATION of a new department to handle all sales of cement mill equipment and composed of men experienced in cement mill operations and pulverizing equipment is announced by the Babcock and Wilcox Co., New York, N. Y.

Organization of this department will include representatives of the company in New York, Atlanta, Chicago and San Francisco who will specialize on pulverizers for coal, raw material and clinker, dryers, feeders, Fuller-Kinyon systems for coal handling, wear resisting castings, and other cement-making equipment under the direction of E. H. Fromm, New York, manager of the new department.

H. B. Smith will represent the new division in the eastern territory. J. G. Burke will represent the new department in the southern territory; H. G. Barnhurst has been appointed middle west representative, while Pacific coast business of this department will be handled by G. C. Barnaby.

Flat Picker

THE NEW improved Cross-Kerrigan flat picker is announced by the Cross Engineering Co., Carbondale, Penn. It is made with right and left staggered rows of raised *C*-shaped leaves, and alternate depressed rectangular leaves. The picker readily sorts flat material from screened aggregate, and is made in sizes to fit any shaking screen, the manufacturer states. Height of opening is easily adjusted, though the height is made to suit individual requirements for each installation.



Flat picker for removing flat material

THE INDUSTRY

Incorporations

Building Materials Co., Oilton, Okla. Capital $10,000. E. Clark, Frank Kuhn.

Pitts Slate Corp., Arvonia, Va., incorporated with capital stock of $25,000. R. H. Sepssard, Richmond.

Missouri Barite Corp., Eldon, Mo. C. F. Denney, Carthage, and J. W. Creech, Joplin, are incorporators.

Rock Asphalt, Inc., Tampa, Fla., granted charter. A. B. McMullen, M. H. Draper, First National Bank Bldg.

The Portage Gravel Co., Cleveland, Ohio. Two hundred fifty shares no par. Bernon, Mulligan, Kelley and Le Fever, Union Trust Bldg.

Paul Lime Plant, Inc., Paul's Spur, Ariz. Capital stock $250,000. Incorporators are Alfred Paul, Sr., Alfred Paul, Jr., and Mabel W. Paul.

Midwest Sand and Gravel Co., Minneapolis, Minn. Capital stock $100,000. Principal office, Great Falls, Mont. F. G. Sampson, representative.

Hope Sand and Gravel Co., Providence, R. I. Capital stock 600 shares common no par. W. Harold Hoffman, Richmond H. Sweet and Samuel H. Levy.

Ready Mixed Plaster Co., Wauwatosa, Wis. Twenty shares, $100 each. E. Groth, B. Seigert, H. Forrer. To deal in ready-mixed plaster, putty and mortar.

James A. Brennan, Inc., Youngstown, Ohio. Incorporators: James A. Brennan, H. H. Wickham and M. L. McCammon. To market new type of building stone.

Remer Coal and Supply Co., Saginaw, Mich., 20,000. Herbert C. Remer, 211 S. Porter St. To manufacture and deal in lime, brick, cement, etc., at 401 S. Water St.

Watson Bros., Inc., Boston, Mass. Capital stock $50,000. 5000 shares at $10 each. George M. Naylor, Jr., Joseph J. Beatty and Kenneth W. Thomson. To deal in mica.

Rio Grande Quarries Co., Houston, Tex. Capital stock 3000 non-par shares. C. B. Porter, B. A. Baldwin and K. N. Hapgood. Mining, quarrying and manufacturing operations.

Standard Cement Co. Incorporated in Delaware, January 31, to engage in mining and dealing in cement. Capital, 2,000,000 no par shares. Corporation Trust Co., agents.

C and K Cast Stone and Block Corp., R. 11, St. Louis county, Jefferson Barracks, Mo. Incorporators: B. J. Compton, Brentwood, and Harry M. Klund of Kirkwood.

Central Silica Corp., Birmingham, Ala. Robert H. Carson, Kirk Henry and F. Robert Switzer. To deal in silica, clays, earth and other non-metallic and metallic minerals as well as chalk products.

American Potash and Super-Phosphate Corp., New Orleans, La. Capital $250,000. Stephen F. Sherman, New York, president, and L. M. Turnbull, vice-president and general manager. Plans establishing four plants. Will extract potash from feldspar, glauconite and other potassium minerals in southern states and also manufacture acid phosphate.

Quarries

R. Newton McDowell Co. has started work at its rock crusher near Avalon, Mo.

Holston Quarry Co., Gaffney, S. C., is defendant in a suit resulting from an accidental death at its plant.

France Stone Co., Toledo, Ohio, are dismantling a crushing plant near Sandusky which it installed some years ago.

Colorado Fuel and Iron Co. has reopened its limestone quarries at Lime, Colo., which have been shut down for more than two years.

Berkeley Stone Corp., Charlottesville, Va., has completed rebuilding its plant near here. It has recently increased its holdings of rock deposits.

Bluffton Stone Co., Bluffton, Ohio, expects to complete a 1000 ft. siding connecting its yards with the main track of the Nickel Plate R. R. in March.

General Crushed Stone Co. has begun dismantling its Little Falls, N. Y., plant. Crusher installed a few years ago being shipped to company's plant at LeRoy.

Los Angeles, Calif. Permit for operating a rock-crushing plant in the San Gabriel wash, one mile south of Duarte, has been granted L. F. DeHarporte.

New Castle Lime and Stone Co., New Castle, Penn., recently entertained members of the Beaver Grange at their regular meeting with interesting moving pictures.

Western Limestone Products Co., Omaha, Neb., has appointed Theodore W. Metcalfe as receiver and plans are under way for reorganization for the company, it is reported.

E. H. Hill, contractor of Dexter, Mo., is negotiating with Joseph T. Meyer for the purchase of rock bluff near Appleton to provide 40,000 tons of rock for use in highway work.

Marlboro, Mass. Experts from Bird and Son of Walpole were here recently to get samples of black rock which they believe is suitable to be used in manufacture of asphalt shingles.

Cedar Rapids, Ia. Linn county has rented rock-crushing equipment and will operate a quarry as an unemployment relief measure. The equipment has been rented for a period of five months.

Waterloo, N. Y. A near-surface deposit of limestone on the Weldon Cook farm near here has been discovered. The Ontario Gravel Co., with plant at Oaks Corners, is considering quarrying the rock.

Tipton, Ia. Objections which have been raised to the condemnation of an acre tract owned by J. C. Wright, near Plano, will be heard by the Cedar county board with a view to securing rock more economically than from the quarries now being used.

C. S. Mundy and Co., near Delaware, Ohio, has changed its name to Mundy and Gard. C. A. Gard has joined the firm as secretary-treasurer. C. S. Mundy will continue as president and general manager of the company. This change resulted after one year of operation by the Mundy company.

Shadyside Coal Co., Bellaire, Ohio, has been enjoined by court order from blasting at its quarry in Bridgeport. Hope is entertained that after a conference with residents who have objected to the blasting an agreement may be reached for a reduction in size of the charges of dynamite used.

Youngstown, Ohio. Rumors that Republic Steel Corp. had purchased properties of the Lake Erie Limestone Co. at Hillsville, Penn., have been denied by Republic officials. A large share of the limestone used in Republic's Youngstown district blast furnaces come from the Hillsville district, although the company owns its own Alabama limestone properties for its southern plants.

Sand and Gravel

Perkins Gravel Co., Perkins, Calif., is starting production of gravel.

Dendinger Gravel Co., Inc., New Orleans, La., has filed notice of dissolution.

Holland Sand Co., Schenectady, N. Y., has filed articles of voluntary dissolution.

Nugent Sand Co., Louisville, Ky., has amended its articles of incorporation extending its corporate life to January 2, 1957.

Northern Indiana Sand and Gravel Co., Wolcottville, Ind., recently had its plant damaged by fire caused from an overheated stove.

Dixie Sand and Gravel Co. has transferred title to real estate valued at $30,000 to the Dixie Sand and Gravel Corp. of Richard City, Tenn.

Roquemore Gravel Co. has been purchased by the Citizens and Southern Co., Savannah, Ga., at a public sale for $50,000 to conclude receivership proceedings.

Bryan, Tex. A gravel washing and grading plant is being built near Smetana by the Union Paving Co., which has the contract for road surfacing work here.

Topeka, Kan. Representative Cochran of Shawnee has proposed a bill which returns sand royalties to the counties and drainage districts in which the streams are located.

Joseph S. Rose has taken over the sand and gravel business of the late James H. McCabe of Taunton, Mass. Mr. Rose was formerly a foreman at the McCabe plant.

Mississippi Sand and Gravel Co. has completed its plant at Rosedale, Miss. The plant is located on the Yazoo and Mississippi Valley R. R. tracks and has a daily capacity of 20 cars.

Bryant and Rollins Construction Co., which has been operating a gravel plant near Waynesville, Mo., had the plant washed from the site recently following heavy rains which flooded the location.

Baker Sand and Gravel Co. is seeking permission to dredge sand and gravel, for commercial purposes, from the upper end of Mobile harbor to Columbus, Miss., on the Tombigbee and to the forks of the Warrior river.

J. S. Kennedy has purchased the Chicago and North Western railway's gravel and sand pit at Pine Lake, Mich. A modern crushing and washing plant will be installed and material will be used for road work on the Gogebic range.

Atlas Sand, Gravel and Stone Co., Hartford, Conn., has announced it will accept tires, gas, oil, shoes, clothing, automobiles, trucks, tobacco and cotton goods in exchange for sand, gravel, traprock and services. The merchandise is needed by company employes.

Sturm and Dillard Co., Circleville, Ohio, has cancelled its charter under the laws of West Virginia and is now incorporated under the laws of Ohio. John L. Dillard has been elected president, succeeding L. E. Sturm who died in August. Mrs. M. L. Dillard, wife of the new president, was elected vice-president.

Sonoma, Calif. Sand and gravel to be used in the construction of the Golden Gate bridge, and also for the San Francisco-Oakland bridge, will be shipped from Petaluma. Haystack bunkers will be greatly enlarged and a spur track of the Northwestern Pacific will be built to the bunkers to make handling of the material convenient and rapid.

Cement

Lawrence Portland Cement Co., Northampton, Penn., has reopened its plant.

Utah Portland Cement Co., Salt Lake City, Utah, expects to be working at capacity soon.

Alpha Portland Cement Co., Easton, Penn., plans resumption of activities at its Birmingham, Ala., plant.

Lone Star Cement Co., Kansas City, Mo., has resumed operations at its Bonner Springs, Kan., plant.

North American Cement Corp., Albany, N. Y., plans to employ 200 men at the Security, Md., plant about March 1.

Allentown Portland Cement Co., Allentown, Penn., has reopened its Evansville plant with a full complement of workers.

Pennsylvania-Dixie Cement Corp. has reopened its cement plant at Richard City, Tenn., after having been closed for one year.

Coulter and Payne, Inc., San Antonio, Tex., has been appointed by the Republic Portland Cement Co. to handle its advertising.

Spokane, Wash. The Spokane County Pomona Grange recently advocated a state-owned cement plant for Washington in a committee report which was adopted.

Nebraska Cement Co., Omaha, Neb., was featured in the February 1 issue of *Sales Management* with a story on "What Is the Secret of a Good Dealer Letter."

National Portland Cement Co., Dallas, Tex., advises plans for reopening its Chubbuck, Calif., plant are indefinite. Changes in the plant are necessary before it can be placed in operation.

Carl R. Smith, Rutledge Pike, Tenn., was awarded $17,500 in suit for $100,000 against Volunteer Portland Cement Co. Mr. Smith claimed damage to his greenhouse from cement dust.

Northwestern States Portland Cement Co., Mason City, Ia., held its annual dinner for employes recently, celebrating its 25th anniversary of the manufacture of the first barrel of cement at the local plant.

Metropolitan Cement Corp., Perth Amboy, N. J., expects to begin manufacture of cement at its new plant within the next 60 days. Charles Edison is president and W. D. Cloos, vice-president and general manager.

Santa Cruz Portland Cement Co., San Francisco, Calif., plans to run its Davenport plant on a full time basis to fill orders they have received to supply 350,000 bbl. of cement for the Madden dam in the Panama Canal zone.

New York, N. Y. The Manchuria Cement Sales Association is to be organized by leading Japanese cement manufacturing concerns interested in exports to Manchuria. Onoda Cement takes the largest share of the newly arranged quota.

Huron Portland Cement Co., Alpena, Mich., plans to erect a permanent storage and shipping plant at Oswego, N. Y., with a storage capacity of at least 15,000 tons. This announcement follows operation of a temporary plant there for about one year.

National Portland Cement Co., Brodhead, Penn., announces election of Thomas V. Cunningham, Jr., and Joseph L. Scott, both of Philadelphia, Penn., as directors of the company. All arrangements have been made to start construction as soon as weather conditions permit, it was stated. The plant will have an annual capacity of 1,250,000 bbl. with provision for doubling that amount.

Universal Atlas Cement Co., Chicago, Ill., has reopened its Hannibal, Mo., plant. A gas line is being laid to intersect the Panhandle Eastern Pipe Line Co.'s mains so that gas may be used for

fuel. It also plans to resume operations on a 35% basis at its Leeds, Ala., plant. Its Independence, Kan., plant recently completed its second consecutive calendar year without accident, the first plant of this company to make this record.

Lime

M. J. Grove Lime Co., Lime Kiln, Md., is contracting road work.

Kimbleton Lime Co., Shawsville, Va., recently had some of its buildings damaged by fire.

Austin White Lime Co., Austin, Tex., is decreasing its capital stock from $100,000 to $80,000.

Chicago Union Lime Works Co., Chicago, Ill., announces it has decreased capital stock from $250,000 to $25,000.

Eagle Rock, Va. J. W. Seay and associates have purchased properties of Moore Lime Co. for $16,500, it is reported.

Morgantown, W. Va. Crushing of agricultural limestone was one of the features at the Farm and Home exhibit held here recently.

Auburn Chemical Lime Co., Roseville, Calif., is now producing 75 tons daily in two kilns which it operates. Charles Kemper of Auburn is manager and John H. Andregg is foreman.

Silica

Columbia, S. C. Southern Silica Mining and Manufacturing Co. is interested in the establishment of a glass plant at their sand pit.

Fredonia, Kan. Business men met and discussed tentative plans for a proposed glass bottle plant to be erected on the site of the former window glass plant at the south edge of this city. Large quantities of silica sand will be required if plans are carried out.

Other Rock Products

Bond Marble and Tile Co. of Oklahoma City, Okla., has started work on a black marble quarry at Leslie, Ark.

Dixie Mining Co., Maryville, Tenn., recently purchased slate properties at Chilhowee and have begun operations.

Everett, Wash. Representatives of the Pacific Graphite Co. are considering development of graphite deposits near Blanchard.

Southern Appalachian Mineral Society is considering an exhibit of minerals from Western North Carolina at the World's Fair to be held in Chicago in 1933.

Washington, D. C. The Court of Customs has been sustained in assessing an added duty on phosphate rock from Morocco, otherwise free of duty. Judgment is affirmed.

U. S. Phosphate Marketing Corp., Meagher, Mont., plans organization of a plant at Deer Lodge to engage in developing western Montana rock phosphate for domestic and foreign trade.

Corpus Christi, Tex. Southern Alkali Corp., which is owned by Pittsburgh Plate Glass Co. and American Cyanamid Co., has started preliminary construction of a $10,000,000 chemical plant here.

Franklin, N. C. W. H. Winley and a group of associates have begun operation, on the headwaters of Cowee creek near here, of a mica plant. They will mine and purchase mica for the manufacture of mica products.

Montreal, Que., Can. Representatives of the asbestos mining industry of the Province recently met in Quebec with Hon. J. E. Perrault, Minister of Roads and Mines, to ascertain the prospects for the coming year.

Montreal, Que., Can. Dr. C. H. Cairnes of the Geological Survey of the Department of Mines has discovered, near Cranbrook, B. C., a large and conveniently situated deposit of crystalline rock magnesite of favorable quality.

C. E. Hines and K. R. Neal are in El Dorado Springs, Mo., laying plans for taking leases in that vicinity on land where rock asphalt is located. They will start a prospect drill to ascertain the limits of the rock asphalt formation.

Armour Fertilizer Works, whose general offices have been located in Chicago, has moved to Atlanta, Ga., where it will make its new headquarters to give closer contact between company executives and operating phases of the business.

Marysville, Ohio. Rock phosphate may be used efficiently for growing pigs and chicks when minerals high in calcium and phosphorus are necessary, says C. H. Kick of the Department of Animal Industry at the Ohio Experiment Station.

American Potash and Superphosphate Corp., New Orleans, La., announces the first plant for extraction of potash from various raw materials will be constructed at Crystal River, Fla., after considerable preliminary work is done. It is also planning erection of a new plant near New Orleans for production of potash.

Personals

Gus H. F. Johannes has been elected president and treasurer of the Glencoe Lime and Cement Co., St. Louis, Mo., to succeed the late E. S. Healey.

J. L. Crosthwait has left the Compania de Cemento Portland "Landa" S. A. Puebla, Mexico, effective December 31. He has served as manager of this company for some time.

F. J. King, chief engineer, Linde Air Products Co., New York, N. Y., was elected president of the Compressed Gas Manufacturers' Association at the annual meeting, held recently.

J. H. Connors, vice-president and general manager of the B. F. Goodrich Co., Akron, Ohio, has been reelected to serve as chairman of the Mechanical Goods Division of the Rubber Manufacturers Association.

George W. Vinzant, manager of Greenville Sand and Gravel Co., Greenville, Miss., will be succeeded by W. E. McCourt. Mr. Vinzant will become manager of either the company's plant at Camden or Memphis, Tenn.

L. W. Shugg, General Electric Co., Schenectady, N. Y., was recently elected president of the Exhibitors Committee Industrial and Power Shows, Inc., New York, N. Y. This committee furnishes information concerning all of the larger industrial shows scheduled each year.

George Oenslager of the B. F. Goodrich Co., Akron, Ohio, recently was awarded the Perkin Medal of the Society of Chemical Industry. The award was for his contribution to the rubber industry, in particular to the vulcanization of organic accelerators and of the carbon black type of tire tread.

Frank H. Gale, manager of conventions and exhibits of the General Electric Co., Schenectady, N. Y., has retired after 43 years of service. L. W. Shugg succeeds Mr. Gale. Mr. Gale will continue as secretary-treasurer of the National Electric Light Association exhibitors' committee and will have general charge of arrangements for the General Electric Co.'s participation in the Century of Progress Exposition, Chicago, until it is opened to the public in June.

Obituaries

Luther Keller, 82, president of the Luther Keller Co., Scranton, Penn., died at his home, December 26.

Millard LeVan, 30, National Lime and Stone Co., Findlay, Ohio, was fatally injured while switching cars.

William Edward McComas, district engineer for the Portland Cement Association, died at his home in Germantown, Penn., after a year's illness.

Willard J. Emerson, 77, died recently at his home in Rochester, N. Y. Mr. Emerson was a retired president of the Genesee Valley Bluestone Quarries.

George Clinton Buquo, 57, Hot Springs, Ark., died February 10. Mr. Buquo had been engaged in the lime and sand and gravel business practically all his life.

George W. Jennings, Jr., 20, son of George W. Jennings, manager of the Gordon Sand and Gravel Co., Denver, Colo., died in service as a seaman on the airplane carrier *Saratoga* at San Pedro, Calif.

William J. Webster, Columbia, Tenn., 86, died January 16. Mr. Webster was actively connected with the Tennessee phosphate industry since 1893, and had many friends in the fertilizer and phosphate industry.

George Webber, 78, died at his home at Marblehead, Ohio, January 27. He was employed by the Kelley Island Lime and Transport Co. for many years and at the time of his death was night watchman at the crusher plant.

Mark Truman Swartz, 57, president of the Nazareth National Bank and a director of the Dexter Portland Cement Co. until it was merged with the Pennsylvania-Dixie Cement Corp., died at his home in Easton, Penn., December 20.

W. Vance Brown, 68, of Asheville, N. C., died at his home, January 6. He was president of the Asheville Mica Co. and the English Richmond Mica Corp. and was prominently identified with other enterprises in that vicinity. He entered the mica mining business in 1885.

Wallace Foster Blackinton, 45, master mechanic for the Union Portland Cement Co., died at his home recently of pneumonia. He helped in the construction of the cement plant at Devil's Slide, Utah, and has been in the company's employ since 1916.

Edwin M. Herr, 72, vice-chairman of the board of directors of the Westinghouse Electric and Manufacturing Co. and an officer of many other organizations, died at his home in New York City, December 24. He served for 18 years as president of the Westinghouse company, which position he relinquished in 1929 to become vice-chairman of the board.

Manufacturers

Falk Corp., Milwaukee, Wis., announce the appointment of Edward P. Connell as vice-president.

Black and Decker Manufacturing Co., Towson, Md., announce the appointment of Robert D. Black as sales manager.

B. F. Goodrich Co., Akron, Ohio, through its "Share-the-Work" campaign, has recalled approximately 500 workers.

Austin-Western Road Machinery Co., Chicago, Ill., had an extensive exhibit at the Road Show held in Detroit recently. Full size portable crushing plants were shown, in addition to many types of road making and maintaining equipment.

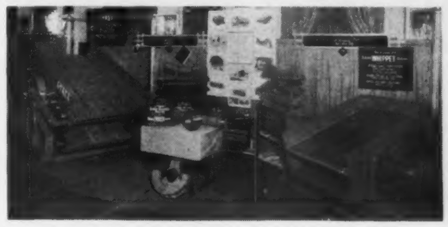
Link-Belt Co., Chicago, Ill., has just received a contract from the Moore-Handley Hardware Co., Birmingham, Ala., for two carloads of Link-Belt equipment.

E. I. Du Pont de Nemours and Co., Inc., Wilmington, Del., recently held its 16th annual convention of the technical section of the explosives department. The meeting was well attended.

Dardelet Threadlock Corp., New York, N. Y., has licensed the Russell, Burdsall and Ward Bolt and Nut Co., Port Chester, N. Y., to manufacture and sell rivet-bolts and nuts with the Dardelet self-locking thread.

Babcock and Wilcox Co., New York, N. Y., announces appointment of E. A. Livingstone as sales representative with headquarters in New York. Mr. Livingstone was formerly with the A. O. Smith Corp.

Robins Conveying Belt Co., New York, N. Y., showed full size screens in its display at the Joint Exhibit at Detroit.



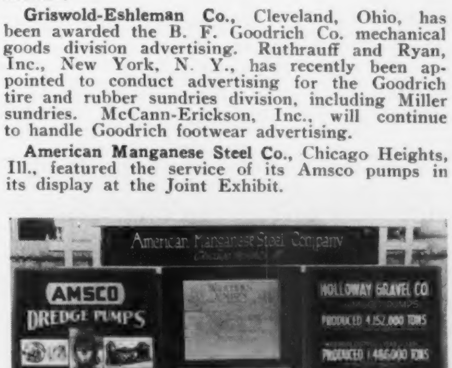
Marion Steam Shovel Co., Marion, Ohio, announces that the H. O. Penn Machinery Co., New York, N. Y., has been appointed distributor for Marion products in Greater New York, Albany, Long Island and northern New Jersey.

Thomas Elevator Co., Chicago, Ill., announces that it has changed its name to Thomas Hoist Co. Its principal business is the manufacture of electric, steam and gasoline hoists and the business of leasing hoists will be conducted by a division of the Thomas Hoist Co.

Poole Foundry and Machine Co., Woodbury, Baltimore, Md., has appointed Frank M. Esch, Houston, Tex., as direct representative for its line of flexible couplings and reduction gears in the state of Texas, and it has also appointed the Rockfield-Davis Equipment Co., Denver, Colo., as representatives in Colorado, Wyoming and New Mexico.

Griswold-Eshleman Co., Cleveland, Ohio, has been awarded the B. F. Goodrich Co. mechanical goods division advertising. Ruthrauff and Ryan, Inc., New York, N. Y., has recently been appointed to conduct advertising for the Goodrich tire and rubber sundries division, including Miller sundries. McCann-Erickson, Inc., will continue to handle Goodrich footwear advertising.

American Manganese Steel Co., Chicago Heights, Ill., featured the service of its Amsco pumps in its display at the Joint Exhibit.



Classified Directory of Advertisers in this Issue of Rock Products

For alphabetical index, see page 80

This classified directory of advertisers in this issue is published as an aid to the reader. Every care is taken to make it accurate, but ROCK PRODUCTS assumes no responsibility for errors or omissions. The publishers will appreciate receiving notice of omissions or errors, or suggestions

Acetylene Welding Rod
Haynes Stellite Co.

Agitators, Thickeners and Slurry Mixers
F. L. Smidth & Co.

Air Compressors
Fuller Co.
Nordberg Mfg. Co.
Traylor Eng. & Mfg. Co.

Air Filters
Fuller Co.

Air Separators
Bradley Pulverizer Co.
Clark Dust Collecting Co.
Kent Mill Co.
Raymond Bros. Impact Pulv. Co.

Alloys (Metal)
Haynes Stellite Co.

Babbitt Metal
Joseph T. Ryerson & Son, Inc.

Backfillers
Austin-Western Road Machy. Co.
Bucyrus-Erie Company
Harnischfeger Corp.
Ohio Power Shovel Co.

Balls, Grinding (See Grinding Balls)

Balls (Tube Mill, etc.)
Allis-Chalmers Mfg. Co.
F. L. Smidth & Co.

Bearings
Chain Belt Co.
Haynes Stellite Co.
Link-Belt Co.
Timken Roller Bearing Co.

Bearings (Anti-Friction)
Timken Roller Bearing Co.

Bearings (Roller)
Timken Roller Bearing Co.

Bearings (Tapered Roller)
Timken Roller Bearing Co.

Bearings (Thrust)
Timken Roller Bearing Co.

Belting
Robins Conveying Belt Co.

Bins
Austin-Western Road Machy. Co. (Sand and Gravel)
Chicago Blow Pipe Co.
Pioneer Gravel Equipment Mfg. Co.
Traylor Eng. & Mfg. Co.

Bin Gates
Chain Belt Co.
Fuller Co.
Link-Belt Co.
Robins Conveying Belt Co.
Traylor Eng. & Mfg. Co.

Blocks (Pillow, Roller Bearing)
Link-Belt Co.
Timken Roller Bearing Co.

Boilers
Combustion Engineering Corp.

Breakers (Primary)
Smith Eng. Works

Buckets (Dragline and Slackline)
Bucyrus-Erie Co.
Hayward Co.
Pioneer Gravel Equipment Mfg. Co.
Wellman Eng. Co. (G. H. Williams Co.)

Buckets (Dredging and Excavating)
Harnischfeger Corp.
Hayward Co.
Wellman Engineering Co. (G. H. Williams Co.)

Buckets (Elevator and Conveyor)
Cross Engineering Co.
Hendrick Mfg. Co.
Link-Belt Co.
Pioneer Gravel Equipment Mfg. Co.
Robins Conveying Belt Co.

Buckets (Clamshell, Grab, Orange Peel, etc.)
Blaw-Knox Co. (Clamshell)
Harnischfeger Corp.
Hayward Co.
Link-Belt Co.
Wellman Engineering Co. (G. H. Williams Co.)

Cableways
Link-Belt Co.
Macwhyte Co.
Wellman Eng. Co. (G. H. Williams Co.)
Williamsport Wire Rope Co.

Cap Crimpers and Fuse Cutters
Ensign-Bickford Co.

Car Pullers
Link-Belt Co.
Robins Conveying Belt Co.

Cars (Quarry and Gravel Pit)
Austin-Western Road Machy. Co.
Easton Car & Construction Co.

Castings
Babcock & Wilcox Co.
Eagle Iron Works (Grey Iron)
Haynes Stellite Co.
Link-Belt Co.
Timken Roller Bearing Co.

Cement Making Machinery
F. L. Smidth & Co.

Cement Pumps
Fuller Co.
F. L. Smidth & Co.

Central Mixing Plants (Concrete)
Chain Belt Co.

Chain (Dredge and Steam Shovel)
Bucyrus-Erie Co.

Chain (Elevating and Conveying)
Chain Belt Co.
Link-Belt Co.

Chain Drives
Chain Belt Co.

Chain Systems (Kilns)
F. L. Smidth & Co.

Chutes and Chute Liners
Cross Engineering Co.

Chutes for Minimizing Segregation
Robins Conveying Belt Co.

Clamshell Buckets (See Buckets, Clamshell, Grab, etc.)

Classifiers
Link-Belt Co.

Clips (Wire Rope)
Macwhyte Co.
Williamsport Wire Rope Co.

Coal Crushers and Rolls
Austin-Western Road Machy. Co.

Coal Pulverizing Equipment
Babcock & Wilcox Co.
Bradley Pulverizer Co.
Pennsylvania Crusher Co.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.

Compressors (See Air Compressors)

Conveyor Idlers and Rolls
Chain Belt Co.
Link-Belt Co.
Robins Conveying Belt Co.

Conveyors and Elevators
Earle C. Bacon, Inc.
Chain Belt Co.
Fuller Company
Lewistown Fdy. & Mach. Co.
Link-Belt Co.
Pioneer Gravel Equipment Mfg. Co.
Robins Conveying Belt Co.
F. L. Smidth & Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.

Conveyors (Pneumatic)
Fuller Company

Conveyors (Screw)
Link-Belt Co.

Coolers (See Kilns and Coolers, Rotary)

Correcting Basins
F. L. Smidth & Co.

Couplings (Flexible and Shaft)
Chain Belt Co.
Link-Belt Co.

Cranes (Clamshell)
Austin-Western Road Machy. Co.
Bucyrus-Erie Co.
Harnischfeger Corp.

Cranes (Crawler and Locomotive)
Austin-Western Road Machy. Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Link-Belt Co.
Ohio Power Shovel Co.

Cranes (Overhead Traveling Electric)
Harnischfeger Corp.

Crushers (Hammer)
Austin-Western Road Machy. Co.
Pennsylvania Crusher Co.

Crushers (Jaw and Gyratory)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Earle C. Bacon, Inc. (Jaw)
Lewistown Fdy. & Mach. Co.
Nordberg Mfg. Co.
Pioneer Gravel Equipment Mfg. Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.

Crushers (Single Roll)
Austin-Western Road Machy. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.
Pioneer Gravel Equipment Mfg. Co.

Crushing Rolls
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Traylor Eng. & Mfg. Co.

Dedusters
Blaw-Knox Co.

Derricks and Derrick Fittings
Harnischfeger Corp.
Hayward Co.
Wellman Eng. Co. (G. H. Williams Co.)

Diesel Engines (See Engines, Diesel)

Dippers and Teeth (Steam Shovel)
Bucyrus-Erie Co.
The Frog, Switch & Mfg. Co.

Ditchers
Bucyrus-Erie Co.
Harnischfeger Corp.

Draglines
Bucyrus-Erie Co.
Harnischfeger Corp.
Link-Belt Co.

Dragline Excavators
Austin-Western Road Machy. Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Ohio Power Shovel Co.

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Link-Belt Co.

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Hayward Co.
Morris Machine Works

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Dryers
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Combustion Engineering Corp.
Traylor Eng. & Mfg. Co.

Dust Collecting Systems
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Clark Dust Collecting Co.

Dust Conveying Systems
Fuller Co.

Electric Mine Hoists
Nordberg Mfg. Co.

Electric Power Equipment
Allis-Chalmers Mfg. Co.

Elevators (See Conveyors and Elevators)

Engineers
Productive Equipment Corp.
Robins Conveying Belt Co.
F. L. Smidth & Co.

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Nordberg Mfg. Co.

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Feeders
Babcock & Wilcox Co. (Pulverized Coal)
Fuller Co. (Cement and Pulverized Material)
Pioneer Gravel Equipment Mfg. Co.
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Gears and Pinions
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Grapples
Hayward Co.

Grapples (Stone)
Hayward Co.
Wellman Eng. Co. (G. H. Williams Co.)

Grinding Balls
Babcock & Wilcox Co.

Grizzlies
Productive Equipment Corp.
Robins Conveying Belt Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.

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